CHAPTER 5
ENVIRONMENTAL CONSEQUENCES

5.0 ENVIRONMENTAL CONSEQUENCES

The following sections evaluate the environmental consequences of proposed Los Alamos National Laboratory (LANL) construction and operations on the surrounding region. The impact on each resource area is evaluated for the three proposed alternatives: the No Action Alternative, Reduced Operations Alternative, and Expanded Operations Alternative. In addition, the analysis looks at the cumulative impacts of these alternatives when combined with other past, present and future actions that could affect the region. As applicable, possible mitigation measures are discussed with regard to implementing one of the proposed alternatives.

As described in earlier chapters, changes have occurred or are expected to take place at LANL that were not anticipated at the time the 1999 *Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico* (*1999 SWEIS)* was issued together with the Record of Decision (ROD). Changes include alteration of the physical environment, as well as changes to LANL's operations and capabilities. The Cerro Grande Fire of 2000 resulted in changes to the physical environment in the form of burned habitat, damaged or destroyed structures, and potential for significant runoff and erosion. Another change to the physical environment is the past and planned conveyance and transfer of certain lands to Los Alamos County and the U.S. Department of the Interior to be held in trust for the San Ildefonso Pueblo that, in effect, changes the site boundaries and removes from National Nuclear Security Administration (NNSA) stewardship the ecological and cultural resources included in those lands.

Included in the analysis supporting this new Site-Wide Environmental Impact Statement (SWEIS) are the impacts associated with manufacturing plutonium pits at LANL. Under the No Action and Reduced Operations Alternatives, the analysis includes the impacts associated with manufacturing up to 20 pits per year in existing facilities in the Plutonium Facility Complex (Technical Area [TA] 55). The Expanded Operations Alternative includes the impacts associated with manufacturing up to 50 pits per year under single-shift operations (80 pits per year using multiple shifts) in TA-55. The manufacturing of pits in TA-55 at any of the levels discussed above is not expected to have a distinguishable effect on a number of the resource areas evaluated in this SWEIS. The different levels of pit manufacturing activities in TA-55 would likely cause only minor differences in impacts on land use, visual resources, water resources, geology and soils, air quality, noise, ecological resources, public health, cultural resources, and infrastructure. Larger impacts would be expected depending on the alternative chosen in terms of worker health, socioeconomics, waste management and transportation.

The changes in the operations and capabilities active at LANL have the effect of potentially changing releases to the environment and the impacts of potential accidents and are factored into the analyses presented below. In addition to changes in LANL operations and the environment, new projects or projects to maintain existing LANL capabilities have also been evaluated for environmental impacts. The impacts of these individual projects are detailed in Appendices G through J and are brought forward and included in this chapter as appropriate. These projects are generally included as part of the Expanded Operations Alternative.

5.1 Land Resources Impacts

This section addresses the impacts of the No Action, Reduced Operations, and Expanded Operations Alternatives on Land Use and Visual Resources. **Table 5–1** summarizes the expected land use impacts for each of the three alternatives.

5.1.1 Land Use

Land use is defined as, "The way land is developed and used in terms of the kinds of anthropogenic activities that occur (e.g., agriculture, residential areas, industrial areas)" (EPA 2003). A comparative methodology was used to determine impacts to land use at LANL. Construction, building modification, operations, and demolition activities associated with each alternative were examined, as appropriate, and compared to existing land use conditions and future land use projections. Impacts were identified as they relate to changes in land use categories, ownership, and alternative or conflicting uses.

5.1.1.1 No Action Alternative

The No Action Alternative is represented by the existing environment as it relates to land use, together with actions that the U.S. Department of Energy (DOE) NNSA decided upon, but that have not been fully implemented, with other National Environmental Policy Act (NEPA) compliance reviews issued since the *1999 SWEIS*. Impacts with regard to land use are described in terms of those projects that impact the site as a whole and those that affect specific TAs. Key Facilities are addressed separately. Only those projects that have been evaluated in their respective environmental analyses as having an impact on land use are addressed below.

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Two projects that are being implemented, and for which NEPA documentation has been prepared since issuance of the *1999 SWEIS* ROD, have potential impacts on land use across a number of technical areas: conveyance and transfer of land under Public Law 105-119, and proposed power grid upgrades (DOE 1999a, 1999d, 2000a).

The conveyance and transfer of land from the DOE to Los Alamos County and the Department of the Interior to be held in trust for the Pueblo of San Ildefonso began in 2002. By the end of 2005, 2,255 acres (913 hectares) had been turned over (see Section 4.1.1). In order to meet the requirements of Public Law 105-119, Section 632, the remaining acreage (1,929 acres [781 hectares]) must be turned over by 2007. Direct impacts of the conveyance and transfer process on land use include a reduction in the size of LANL from 27,520 acres (11,137 hectares) to 25,600 acres (10,360 hectares). Indirect impacts (that is, impacts resulting from actions undertaken by the recipients after the proposed conveyance and transfer of the tracts) include possible development or redevelopment of up to 826 acres (334 hectares), the potential for the introduction of land uses that would be incompatible with adjacent land owners' resource protection efforts, and the loss of recreational opportunities on some tracts (DOE 1999d).

Table 5–1 Summary of Environmental Consequences of Land Use Changes

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site			
	Land Conveyance and Transfer – 1,929 acres (781 hectares) would be conveyed or transferred. – Development could occur on up to 826 acres (334 hectares). – Potential introduction of incompatible land uses. – Loss of recreational opportunities. Power Grid Upgrades – 473 acres (191 hectares) affected by upgrades. – Project generally compatible with existing land use, but some constraint on high explosives testing and future experimental use within part of LANL. Wildfire Hazard Reduction Program – No impact Disposition of Flood Retention Structures – No impact	Same as No Action Alternative	Same as No Action Alternative plus: MDA Remediation Project – Fewer restrictions on land use for the removal option than the capping option. – No major changes in land use designations in most cases since surrounding land uses would remain in their current classification; however, some land use changes possible. Security-Driven Transportation Modifications Project – Most development would not conflict with current land use designations. – Auxiliary Action A – Within scope of current land use plans. – Auxiliary Action B – Partially within scope of current land use plans; however, plans have no provision for a bridge over Sandia Canyon.
Affected Technical Areas			
TA-3	No change in land use	Same as No Action Alternative	Replacement Office Buildings – 13 acres (5.3 hectares) of undisturbed land would be developed. – Development would be consistent with a change in future land use from Reserve to Physical/Technical Support.
TA-21	No change in land use	Same as No Action Alternative	TA-21 DD&D – Future LANL development could negate the proposed change in land use from the current designation to Reserve.
Remote Warehouse and Truck Inspection Station (TA-72)	No change in land use	Same as No Action Alternative	– Construction would affect 4 acres (1.6 hectares) of undisturbed land. – Land use designation would change from Reserve to Physical/Technical Support.
Key Facilities			
Pajarito Site DD&D (TA-18)	No change in land use	Same as No Action Alternative	Disposition acreage for future use. Land use could change from Nuclear Material Research and Development to Reserve.
Radiochemistry Facility (TA-48)	No change in land use	Same as No Action Alternative	– 12.6 acres (5.1 hectares) of undeveloped land to be developed. – Land use change is consistent with future land use designations.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Radioactive Liquid Waste Treatment Facility (TA-50)	No change in land use	Same as No Action Alternative	– Construction of the liquid waste management building would not result in a change in land use. – Construction would affect 4 acres (1.6 hectares) of undeveloped land. – New evaporation basins, if built, would likely result in a change in land use designation from Reserve to Waste Management.
Bioscience Facilities	No change in land use	Same as No Action Alternative	– Construction would affect 5 acres (2 hectares) of undeveloped land. – For Options 1 and 3 development would be consistent with a change in future land from Reserve to Experimental Science. – For Option 3 there would be no change in land use designation.

MDA = material disposal area, TA = technical area, DD&D = decontamination, decommissioning, and demolition.

Although the Power Grid Infrastructure Upgrades Project is not expected to have a major effect on existing land uses, it would affect up to 473 acres (191 hectares) and be 19.5 miles (31 kilometers) in length. In general, it would traverse the southwestern portion of LANL, entering the site from the east at TA-70 and proceeding northwest through portions of White Rock, Water and Pajarito Canyons, and terminating at TA-69. Construction and operation have been determined to be consistent and compatible with all existing land uses along the project's route and these land uses would likely continue. However, several minor impacts are possible including short-term impacts on cattle grazing and recreational use during construction on one segment that is outside of LANL and potential adverse effects on existing or future high explosives testing within LANL. Additionally, the project could provide a minimal constraint within the Dynamic Testing area and Twomile Mesa South within areas designated for future experimental use, as development could not occur within the right of way (DOE 2000a).

5.1.1.2 Reduced Operations Alternative

Los Alamos National Laboratory Site-Wide and Technical Area Impacts

Under the Reduced Operations Alternative, impacts on land use from those actions addressed for the No Action Alternative (see Section 5.1.1.1) would still take place. None of the actions proposed under the Reduced Operations Alternative that differ from those proposed under the No Action Alternative would impact land use.

5.1.1.3 Expanded Operations Alternative

The Expanded Operations Alternative reflects proposals that would expand the overall operations level at LANL above those established for the No Action Alternative, which would still take place. Additionally, the Expanded Operations Alternative includes a number of new projects that have the potential to impact land use at LANL. Not all new projects would affect land use, because many would involve actions within or modifications to existing structures or construction of new facilities within previously developed areas of LANL. Only those proposed projects that would impact land use are addressed below.

Los Alamos National Laboratory Site-Wide Impacts

Under this alternative, there are two proposed actions that have the potential to impact land use across a number of technical areas at LANL. These are material disposal area (MDA) Remediation and the Security-Driven Transportation Modifications Project. A detailed analysis of each of these two actions is presented in Appendices I and J, respectively.

Action options for remediation of MDAs include capping or removal. Remedies would be recommended by LANL, but decisions would be made by the New Mexico Environment Department (NMED). Decisions on actions would be implemented on an MDA-by-MDA basis and could involve a combination of partial removal and capping (a hybrid action for the purposes of this analysis). Because the Capping Option would stabilize rather than remove existing contaminants, future use of MDAs would remain restricted. At present, most are open areas that are fenced and excluded from any use other than safely maintaining inventories of waste. In the future, the MDAs would have to be surveyed and maintained to protect public health and safety

and the environment. Under the Removal Option, there would be fewer restrictions on land use than under the Capping Option. Complete removal of waste and contamination could free up to roughly 110 acres (45 hectares) for purposes other than as an exclusion area for radioactive waste. However, this would not mean that there would be major changes in the designated land use of the technical areas containing the MDAs. The extent of removal would depend on information obtained from the program and on regulatory decisions.

The investigation, remediation, and restoration program for MDA B would remove at least some waste and contamination. Alternative uses for this portion of TA-21 may be possible. Opportunities for different uses of some lands may arise following potential release site (PRS) remediation. This would depend on the corrective measure required by NMED and implemented by LANL, and the overall mission of the TA containing the PRS. Under a hybrid action, land use generally would be similar to that for the Capping Option.

Security-driven transportation modifications in the Pajarito Corridor West would require construction of two parking lots or structures (in TA-48 and TA-63), a new two-lane road along the east edge of TA-63, new auto and pedestrian crossings connecting TA-63 and TA-35, and a road through the northern edge of TA-35. While this alternative would affect future land use by developing currently undeveloped portions of the Pajarito Corridor West, all construction, except the pedestrian walkway, would take place within areas designated either for development or for infill. Thus, this alternative generally would be compatible with land use plans for the Pajarito Corridor West as set forth in the *Comprehensive Site Plan 2001* (LANL 2001c).

Auxiliary Action A for the Security-Driven Transportation Modifications Project involves construction of a two-lane bridge within a 1,000-foot (300-meter) wide corridor across Mortandad Canyon and a new two-lane road from the north end of the new bridge westward through TA-60 to connect TA-35 with TA-3. These actions are within the scope of the land use plans as set forth in the *Comprehensive Site Plan 2001*. A second action involves construction of a second new two-lane bridge which would be constructed within a 1,000-foot (300-meter) wide corridor across Sandia Canyon and a new two-lane road from the new bridge to connect with East Jemez Road. Although the terminus of the bridge and the new road to East Jemez Road would be within an area designated as Primary Development in the *Comprehensive Site Plan 2001*, there is no provision in the plan for a bridge corridor over Sandia Canyon, as is the case for the bridge over Mortandad Canyon. Thus, construction of the Sandia Canyon bridge would represent a departure from the current site development plan; however, the 2000 Plan did address the concept of a future road over the canyon (LANL 2000a, 2001c).

Technical Area Impacts

Two projects are proposed that have potential impacts on land use within TA-3 and TA-21. These are addressed below.

Technical Area 3

Construction of the Replacement Office Buildings would require 13 acres (5.3 hectares) of undeveloped land within TA-3 that is presently designated as Reserve. Additional acreage would be required within recently disturbed portions of the TA that are classified as Physical/Technical

Support. The future land use proposal calls for the Reserve area to be redesignated as Physical/Technical Support.

Technical Area 21

Following decontamination and demolition of its buildings and structures, a 7.6-acre (3.0-hectares) parcel in the western portion of TA-21 was conveyed to Los Alamos County. In the future, it is likely that this area could be used for commercial or industrial purposes. The eastern portion of TA-21 would remain a part of LANL for the foreseeable future. However, portions of the eastern parcel are being considered as brownfield sites for potential reuse. Future land use proposals call for this area to be redesignated from Waste Management, Service/Support, and Nuclear Materials Research and Development to Reserve. However, redevelopment could negate this change in designation (see Appendix H).

Key Facilities Impacts

Five projects with land use impacts are being proposed that are related to Key Facilities at LANL as discussed below.

Pajarito Site

The decontamination, decommissioning, and demolition (DD&D) of TA-18 buildings and structures would result in an overall change in the land use designation of the TA, since the site would not be used for other LANL-development purposes. The land use designation of the site would change from Nuclear Material Research and Development to Reserve.

Radiochemistry Facility

Construction of the Radiological Sciences Institute would require about 33.6 acres (13.6 hectares) of land mainly within TA-48 and a small part of TA-55, of which about 12.6 acres (5.1 hectares) are currently undeveloped. Development would require that some areas currently designated Reserve and Experimental Science be redesignated as Nuclear Materials Research and Development; however, this is consistent with future land use concepts since TA-48 is within the Pajarito Corridor West Development Area. Construction of the Radiological Sciences Institute would take place in areas designated as Primary Development, Proposed Parking, and Potential Infill.

Radioactive Liquid Waste Treatment Facility

Construction of the new liquid waste management building would occur in a developed area of TA-50 and would not result in changes to the current or future land use designation of Waste Management. If the evaporation basins, which could occupy up to 4 acres (1.6 hectares) of land, were constructed near the border of TA-52 and TA-5, the land use designation for the basin areas, as well as a portion of the pipeline route, would likely change from Reserve to Waste Management.

Science Complex

Under the Northwest TA-62 Site option a site located immediately to the west of TA-3 would be used for construction of the Science Complex. Current land use within the site area is classified as Reserve and has not been predicted to change in the future (LANL 2003g). Thus, construction of the Science Complex, which would disturb 5 acres (2 hectares) of undeveloped land, would result in a change in future land use from Reserve to Experimental Science.

Remote Warehouse and Truck Inspection Station

Construction of the Remote Warehouse and Truck Inspection Station along the south side of East Jemez Road would require the clearing of about 4 acres (1.6 hectares) of land. Since current and future land use within the site area is designated as Reserve, development of the site would represent a change in land use from Reserve to Physical/Technical Support.

5.1.2 Visual Environment Impacts

Visual resources are natural and manmade features that give a particular landscape its character and aesthetic quality. The analysis of impacts to visual resources was comparative and consisted of a qualitative examination of potential changes in the visual environment. Aspects of visual modification examined included site development, building modification, and demolition, as appropriate. Each of these activities could alter the appearance of LANL structures or obscure views of the surrounding landscape, result in changes in surrounding land cover that could make structures more or less visible, and cause light pollution that would alter the night sky. **Table 5–2** summarizes the expected impact on visual resources at LANL.

5.1.2.1 No Action Alternative

The No Action Alternative is represented by the existing visual environment at LANL, including actions that DOE or NNSA has decided upon, but that have not been fully implemented, with other NEPA compliance reviews issued since the *1999 SWEIS* ROD. Impacts to the visual environment are described in terms of those projects that impact the site as a whole and those that affect specific technical areas. Key Facilities are addressed separately. Only those projects that have been evaluated in their respective environmental analyses as having an impact on the visual environment at LANL are addressed below.

Los Alamos National Laboratory Site-Wide Impacts

The conveyance and transfer of land to Los Alamos County and Department of the Interior to be held in trust for the Pueblo of San Ildefonso has been evaluated with respect to impacts on the visual environment. Most tracts would maintain their current level of visual aesthetic value after conveyance and transfer and any subsequent development, and the visual resources of some tracts could be improved by the removal and replacement of industrial buildings. However, the evaluation also determined that the potential commercial and residential development of currently undeveloped areas, such as the Rendija Canyon and White Rock Tracts, could degrade the local visual landscape. Overall, the reduction in visual quality was not found to be substantial on a regional scale (DOE 1999d).

Table 5–2 Summary of Environmental Consequences on the Visual Environment

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site			
	Land Conveyance and Transfer: – Development could degrade views of presently undeveloped tracts. Power Grid Upgrades: – Short-term visual impacts during construction. – Adverse visual impact in undisturbed areas. – No overall change in view from Bandelier National Monument. Wildfire Hazard Reduction Program: – Forest would appear more park-like. – Some LANL facilities would be more visible. Disposition of Flood Retention Structures: – Temporary impacts if staging areas are located near Pajarito Road. – Overall, little impact, since most disposition projects are not visible to the public.	Same as No Action Alternative	Same as No Action Alternative plus: MDA Remediation Project: – Short-term visual impacts during MDA capping or removal and during remediation of other PRSs. – Temporary containment domes used under MDA Removal Option. – Minor changes in distant views if MDAs are capped; would be maintained as open grassy areas. – Borrow pit in TA-61 would become more visible due to the large quantities of material needed. Security-Driven Transportation Modifications Project: – Short-term impacts during construction. – Pronounced impacts due to parking lots, as well as vehicle and pedestrian bridges under all auxiliary actions.
Affected Technical Areas			
TA-3	No change in impacts to visual resources	Same as No Action Alternative	Center for Weapons Physics Research: – Short-term impacts during construction. – New structures would be of a unified design. – Demolition of vacated structures would improve the overall appearance of TA-3, TA-35, and TA-53. Replacement Office Building Project: – Short-term impacts during construction. – New buildings and parking lot would be readily visible from West Jemez Road and Pajarito Road. – Impact of the project on distant views would be minimal.
TA-21	No change in impacts to visual resources	Same as No Action Alternative	TA-21 DD&D: – Enhancement of visual environment from removal of old structures. – Both conveyed and non-conveyed parcels could undergo development, which could change the visible environment.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Key Facilities			
Chemistry and Metallurgy Research (TA-3, TA-48, and TA-55)	– Temporary impacts during construction of replacement building. – Minimal visual impact to public from Pajarito Plateau rim and employees from Pajarito Road.	Same as No Action Alternative	Same as No Action Alternative
High Explosives Processing Facility (TA-16)	– Temporary impacts during construction of replacement building. – New structures of unified design. – Removal of old buildings would enhance visual environment.	Same as No Action Alternative	Same as No Action Alternative
High Explosives Testing Facility (TA-6, TA-22, and TA-40)	– Temporary impacts during construction of new buildings. – Minimal long-term impacts. – Removal of old buildings would enhance visual environment.	Same as No Action Alternative	Same as No Action Alternative
Pajarito Site DD&D (TA-18)	No change in impacts to visual resources	Same as No Action Alternative	– Short-term impact from demolition. – Long-term positive impact as area is restored to more natural appearance.
Radiochemistry Facility (TA-48)	No change in impacts to visual resources	Same as No Action Alternative	– Short-term impacts during demolition and construction. – Minimal visual impact to public from Pajarito Plateau rim and employees from Pajarito Road from new construction west of current buildings.
Radioactive Liquid Waste Treatment Facility (TA-50)	No change in impacts to visual resources	Same as No Action Alternative	– Short-term impact from construction of new treatment building in TA-50. – Permanent change to the visual environment if evaporation basins are built near the border of TA-52 and TA-5.
Solid Radioactive and Chemical Waste Facilities (TA-50 and TA-54)	No change in impacts to visual resources	Same as No Action Alternative	– Short-term impacts during construction. – Beneficial impact on near and distant views from removal of white-colored domes in TA-54. – Minimal visual impact of new Transuranic Waste Processing Facility to public from Pajarito Plateau rim and employees from Pajarito Road.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Bioscience Facilities	No change in impacts to visual resources	Same as No Action Alternative	The Science Complex Project includes: – Short-term impacts during construction. – Under Options 1 and 2, the new facility would be readily visible from West Jemez Road and forested buffer between LANL and Los Alamos Canyon would be lost. – Potential impacts to Los Alamos Canyon from night lighting under Options 1 and 2. – Minimal impact under Option 3 since the new facility would be generally located within a developed part of TA-3.
Remote Warehouse and Truck Inspection Station (TA-72)	No change in impacts to visual resources	Same as No Action Alternative	– Short-term impacts during construction. – 4 acres (1.6 hectares) would be cleared making the site readily visible from East Jemez Road. – Lighting could be visible from Bandelier National Monument.

MDA = material disposal area, PRS = potential release site, TA = technical area, DD&D = decontamination, decommissioning, and demolition.

The power grid infrastructure upgrades project was determined to affect the visual environment in the vicinity of the right-of-way both during and after construction. During construction staging areas and equipment would cause short-term visual effects that would be out of character with the surrounding environment. However, revegetation after construction would return disturbed areas to a more natural condition. Analysis determined that after construction, the power line would have two principal visual effects – selectively cleared corridors in wooded areas and visible pole structures and lines that would contrast with natural landforms. Because the corridors would be cleared selectively, no major swathes of devegetated areas would be visible. The finished power line would be most disruptive in areas where the surrounding area is undeveloped, or where the contrast with the natural landscape is marked. The evaluation determined that there would not be a dramatic change to the overall character of the view from the Bandelier National Monument Wilderness Area (DOE 2000a).

The Wildfire Hazard Reduction Program was found to have minimal effect on visual resources at LANL and the surrounding area given the degraded panoramas of the Pajarito Plateau and Jemez Mountains resulting from the Cerro Grande Fire. The primary aspect of the program that would affect visual resources is vegetation removal that would occur as a result of selected thinning activities. The forest at LANL would become more natural with an increase in the diversity of shrubs, herbs, and grasses in the understory. Some facilities currently screened from casual view could become visible to viewers at various vantage points. The overall effect of the Wildfire Hazard Reduction Program would be to make the contrast between the background setting and LANL's industrial character more obvious (DOE 2000e).

The disposition of flood and sediment retention structures was determined to have a temporary effect on visual resources if staging areas for the concrete removal were located near Pajarito Road. The actual demolition of the flood retention structure in Pajarito Canyon and the steel diversion wall upstream from TA-18 would take place in restricted areas and not be visible to the public. The low-head weir, located in Los Alamos Canyon, and the road reinforcements in Twomile Canyon, Pajarito Canyon, and Water Canyon would remain in place, with no change in visual resources (DOE 2002i).

Technical Area Impacts

No actions are contemplated under the No Action Alternative that would impact visual resources in terms of the TAs beyond the impacts related to Key Facilities as discussed below.

Key Facilities Impacts

Since the publication of the *1999 SWEIS*, NEPA compliance has been completed for three currently active projects related to Key Facilities. These include the Chemistry and Metallurgy Research Building Replacement TA-55, the Weapons Manufacturing Support Facility at TA-16, and the Dynamic Experimentation Complex at TA-6, TA-22, and TA-40. Impacts to visual resources of these projects are discussed below.

Chemistry and Metallurgy Research Building

Impacts to visual resources resulting from construction of the Chemistry and Metallurgy Research Building Replacement at TA-55 were determined to be temporary in nature and include increased levels of dust and human activity. When complete, the general appearance of the new facility, which would include two buildings, would be consistent with other buildings located within TA-55. The Chemistry and Metallurgy Research Building Replacement would be readily visible to LANL employees from Pajarito Road. It would also be visible to the public from the upper reaches of the Pajarito Plateau rim (which would consist of six new one- to two-story buildings as well as modifications to roads, parking lots, and fencing) (DOE 2003f). Future DD&D of the Chemistry and Metallurgy Research Building would likely result in a temporary park-like area once the site was revegetated. However, as it is likely that infill building would occur later; no long-term visual change is likely, therefore, although new construction would blend in with modern construction.

High Explosives Processing

Construction and demolition at the Weapons Manufacturing Support Facility at TA-16 would have some local short-term adverse effects and long-term beneficial effects on the viewscape. Short-term adverse visual effects would occur during the construction period. Since the existing engineering complex is highly industrial in appearance, these effects would be minor. In the long term, the area would experience a beneficial effect in that temporary buildings would be removed and newly built structures would be of a similar style. The visual effects of the new facilities would be confined to the immediate area of the current complex since the area is generally not visible from public roads. Demolition activities would generally result in the same local short-term adverse effects identified for the construction phase. Overall, the removal of buildings would enhance the visual characteristics of TA-3, TA-8, and TA-16 (DOE 2002k).

High Explosives Testing

Construction activities related to the Dynamic Experimentation Complex at TA-6, TA-22, and TA-40 were determined to have some local short-term adverse effects on visual resources; long-term effects from construction and demolition are expected to be minimal. The project, which would involve constructing 15 to 25 new one- to two-story buildings, as well as new roads and parking lots, is generally not visible from public roads, and new buildings would be similar in height to existing structures. The visual effects of construction would be confined to the immediate area. In the long term, the area would experience minimal effects since it would still resemble an industrial park, but on an expanded scale, with similar architecture. Demolition activities would generally result in the same local short-term adverse effects identified for the construction phase. Overall, the removal of buildings would enhance visual characteristics, with some areas being returned to more natural conditions (DOE 2003g).

5.1.2.2 Reduced Operations Alternative

Under the Reduced Operations Alternative, impacts on the visual environment from actions addressed for the No Action Alternative (see Section 5.1.2.1) would still take place.

5.1.2.3 Expanded Operations Alternative

The Expanded Operations Alternative reflects proposals that would expand the overall operations level at LANL in addition to those established for the No Action Alternative. Additionally, the Expanded Operations Alternative includes a number of new projects that have the potential to impact the visual environment at LANL. Not all new projects would affect the visual environment since many would involve actions within or modifications to existing structures. Only those projects that impact the visual environment are addressed below.

Los Alamos National Laboratory Site-Wide Impacts

Two proposed actions have the potential to impact visual resources across a number of technical areas at LANL: the MDA Remediation Project and the Security-Driven Transportation Modifications Project. A detailed analysis of each is presented in Appendices I and J, respectively.

Action options for remediation of MDAs include capping or removal. A combination of capping and removal could also be selected. Remedies would be recommended by LANL on an MDA-by-MDA basis with the decision being made by NMED. Each option would have some temporary short-term visual impacts resulting from activities such as stripping or disrupting the existing vegetative cover over the MDAs, removing waste, placing cover materials in compacted lifts, and providing for revegetation. Not all land would be affected at the same time. Many of the affected sites would not be in areas routinely visible by the public; however, a number of the MDAs are located on DP Mesa in TA-21 and are visible from the Los Alamos townsite. Remediating the MDAs would present a relatively minor impact on visual resources from higher elevations to the west and, in a few cases, from the townsite. Once capped, the views would generally be similar to those in existence prior to the implementation of corrective measures. One difference between the capping and removal options is that under the latter, as needed, the MDAs would be covered by containment structures while waste was removed. (The investigation, remediation, and restoration program at MDA B would also be conducted under containment structures.) These domed structures would be visible from greater distances than would the MDAs under the capping option; however, their presence would be temporary. After waste removal was completed, the structures would be removed and the site revegetated. Under both options, the need to obtain fill may require removal of a small hill that currently screens the TA-61 borrow pit from observation from East Jemez Road. Thus, the borrow pit, which is a cleared area several acres in size, might become visible from East Jemez Road and would remain visible until ultimately reclaimed and revegetated. Remediating the additional PRSs would result in few additional long-term visual impacts.

The Security-Driven Transportation Modifications Project would take place within Pajarito Corridor West, which is a highly developed area that is readily visible from both nearby and higher elevations to the west. While many actions associated with implementing the Security-Driven Transportation Modifications Project would have little or no visual impact, the construction of the two parking lots, new roads across TA-63 and TA-35, and highway and pedestrian bridges over Ten Site Canyon would noticeably add to the built-up appearance of the area. Visual impacts of constructing the parking lots, highway, and pedestrian bridges would be especially pronounced since they would involve removal of existing forest and span a forested

canyon that has an otherwise natural appearance. The bridges would be readily visible from the canyon where little development is presently apparent; they would also be visible from more distant areas.

Auxiliary Action A for the Security-Driven Transportation Modifications Project involves construction of a two-lane bridge within a 1,000-foot (300-meter) wide corridor across Mortandad Canyon and a new two-lane road from the north end of the new bridge westward through TA-60 to connect TA-35 with TA-3. While the roadway would have minimal impact on visual resources since it would follow an existing unpaved road, the proposed bridge would represent a highly visible change in the appearance of the local environment and would be in contrast to the forested setting of the canyon, altering its natural appearance as viewed from both nearby locations and higher elevations to the west.

Auxiliary Action B involves construction of a second, new two-lane bridge that would be built within a 1,000-foot (300-meter) wide corridor across Sandia Canyon and a new two-lane road from the new bridge to connect with East Jemez Road. Impacts on visual resources would be similar to those addressed above for the first action.

Technical Area Impacts

Three projects are being planned that have potential impacts on visual resources at TA-3 and TA-21. These are addressed below.

Technical Area 3

Construction of the Center for Weapons Physics Research would result in short-term impacts to the visual environment, including construction activities and increased dust generation. Once complete the facility would be visually compatible with nearby office and computing structures and would enhance the overall architectural character of the Core Development Area. Distant views of TA-3 would not appreciably change due to the highly developed nature of the area. DD&D of buildings vacated as a result of the project would cause temporary construction related impacts, but in the long term would improve the general appearance of TA-35 and TA-53.

Construction of the Replacement Office Buildings would require that 13 acres (5.3 hectares) be cleared and graded. This would result in short-term impacts to the visual environment, including construction activities and increased dust generation. The forested area along West Jemez Road within which the project would be built would be replaced with buildings and a parking lot that would be readily visible from West Jemez Road, Pajarito Road, and nearby areas. However, views from Pajarito Road would only be apparent to employees since the road is closed to the public (see Appendix G). Due to the highly developed nature of TA-3, distant views would not change appreciably.

Technical Area 21

DD&D activities at TA-21 would have short-term adverse impacts on visual resources due to the presence of heavy equipment and an increase in dust. Following removal of buildings and structures, the area would be contoured and revegetated, as appropriate. However, since both the western part of the site, which has been be transferred to Los Alamos County, and the eastern

section could be developed in the future, these efforts would be aimed primarily at soil stabilization and not at recreating a more natural environment. With redevelopment likely, future views of the TA from State Route 502 and from higher elevations to the west would remain commercial or industrial in nature. Nevertheless, with proper planning, the view would be of modern architecturally compatible buildings rather than the current mix of 50-year-old structures (see Appendix H).

Key Facilities

Three projects are being proposed that are related to Key Facilities at LANL under the Expanded Operations Alternative as discussed below.

Pajarito Site

The use of heavy equipment for DD&D of buildings at TA-18 and the resultant increase in dust would have short-term impacts on visual resources; however, long-term impacts would be positive. Once buildings and structures were removed and the site restored, including grading and planting of native species, the canyon bottom would present a natural appearance and, given time, would blend with previously undisturbed portions of the TA (see Appendix H).

Radiochemistry Facility

Construction of the Radiological Sciences Institute would result in changes in both near and distant views of TA-48. Short-term impacts would include construction activity itself, as well as increased dust generation. Upon completion, the new buildings and parking lots would be more visible from the road than current facilities due to their increased number and size. Most of the changes to area views would only be visible to LANL workers. Construction of the Radiological Sciences Institute would also change distant views of TA-48, since the size of the developed area would increase as well as the number of buildings and parking lots. The overall broad viewshed effect would be minimal due to the extensive nature of existing development on the mesa.

The demolition of buildings and structures at TA-48 prior to constructing the Radiological Sciences Institute would have short-term and long-term impacts on visual resources. In the short-term, dust and demolition activity would adversely affect these resources; however, in the long-term, the new facility would be more aesthetically pleasing in terms of architectural style than the mix of existing structures. These changes would primarily be observed by LANL employees. Also, distant views from higher elevation to the west would not appreciably change (see Appendix G).

Construction of the new treatment building in TA-50 would result in temporary local visual impacts. Once built the new treatment building would not result in a change to the overall visual character of TA-50. However, the current natural setting in the area of the evaporation basins and a portion of the pipeline would be disrupted by the removal vegetation and construction activities.

Radioactive Liquid Waste Storage Facility

Construction would consist of either a single treatment building or two treatment buildings, with the possibility of renovation of existing buildings. Regardless of the construction option, visual impacts would be temporary and localized. Any new buildings that would be constructed would be no more than two stories high with established color schemes for building exteriors. If evaporation basins are constructed, there would be a permanent change to the visual environment because the area near TA-52 and TA-5 where the basins would be constructed is currently undeveloped and wooded. This natural setting would be disrupted by a noticeable break in the forest cover from higher areas to the east of LANL.

Solid Radioactive and Chemical Waste Facilities

Waste Management Facilities Transition activities primarily would involve work within TA-54, TA-50, and TA-63. Actions taking place within TA-54, including some new construction and removal of the white-colored domes and other facilities, would occur within previously disturbed areas. While most activities taking place within TA-54 would have minimal impact on visual resources due to the developed nature of the area, removal of the white-colored domes at MDA G would have a beneficial impact on both near and distant views, since these structures can be seen many miles away from areas in the Nambe and Espanola area and from areas in western and southern Santa Fe. They are also visible from the lands of the Pueblo of San Ildefonso. A Transuranic Waste Processing Facility would be required and could be located within either TA-50 or TA-63. However, since Pajarito Road is closed to the public, the view of this facility would only be available to LANL employees. Regardless of where a Transuranic Waste Processing Facility would be constructed, the presence of equipment and dust would cause temporary impacts on visual resources. There would be little impact to the viewshed from higher elevations to the west due to the existing highly developed nature of LANL along Pajarito Road.

A second option related to the Waste Management Facilities Transition would require additional storage space for remote-handled and contact-handled transuranic waste that could be co-located with the Transuranic Waste Processing Facility or be separate from it. This option also involves upgrading satellite storage areas around LANL for mixed low-level radioactive waste and hazardous or chemical waste. In general, impacts on visual resources of this option would be similar to those described above since similar actions would take place within the same technical areas (see Appendix H).

Science Complex

The Science Complex would consist of two, four-story buildings and a six-story parking structure, as well as related supporting structures and utilities. Construction of the complex would result in temporary visual impacts related to the presence of heavy equipment and dust. Once complete the addition of the Science Complex at the Northwest TA-62 Site or Research Park Site would result in an impact to visual resources in this area because views from TA-3 or from West Jemez Road to the west, north, and east would be obstructed. Also, with the construction of the Science Complex on the north side of the road the natural forested buffer area between LANL and Los Alamos Canyon would be lost. These options would add somewhat to the overall built up appearance of LANL when viewed from higher elevations to the west. Under

the South TA-3 Site option there would be little overall impact to visual resources since the Science Complex would be within a highly developed part of LANL.

Under the Northwest TA-62 Site or Research Park Site options it is possible that the security lighting associated with the Science Complex may illuminate some portion of the south and north canyon walls of Los Alamos canyon. However, the project would conform to the New Mexico Night Sky Protection Act per architectural and design guidelines and LANL engineering standards. Impacts from night lighting under the South TA-3 option would not be expected.

Remote Warehouse and Truck Inspection Station

Construction of the Warehouse and Truck Inspection Station would result in temporary visual impacts related to clearing activities, the presence of heavy equipment, and dust. Once complete the facility would be readily visible from East Jemez Road. Nighttime lighting would be required in a location that was previously unlighted. Although the Remote Warehouse and Truck Inspection Station would not be visible from the trails or parking lot at the Tsankawi Unit of Bandelier National Monument, the nighttime sky glow from lighting at the facility could be visible from Tsankawi under normal conditions. However, the trails at Tsankawi are closed to the public after dusk. Lighting to be installed would comply with the New Mexico Night Sky Protection Act to the extent it does not compromise security.

5.2 Geology and Soils

This section discusses the projected impact on LANL geology and soils under the three alternatives evaluated in this SWEIS. In general, LANL operations have limited impact on geology and soils, except in specific circumstances. This is because the majority of LANL is not industrialized, so the majority of the soil column is not disturbed, and few LANL processes involve subsurface work, so there is limited interaction with geological materials. The information for the geology and soils sections feeds into several other sections within this new SWEIS, including human health, accidents, and ecological risk. The following section addresses each of the subject areas previously described in Chapter 4, Affected Environment.

Table 5–3 presents a summary of the impacts for each of the proposed alternatives with respect to geology and soils.

Table 5–3 Summary of Environmental Consequences for Geology and Soils

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site			
	Volcanism & Seismic Activity: – No activities that could increase the probability of seismic events. Slope Stability, Subsidence, & Soil Liquefaction: – No impact. Soil Monitoring: – No increase in the level of legacy contaminants. – Overall decrease in soil contamination occurring over time. Soil Erosion: – No impact. Mineral Resources: – No impact.	Same as No Action Alternative, except: Soil Monitoring: – Potential for soil contamination would decrease due to the 20 percent reduction in high explosives testing.	Same as No Action Alternative, except: Soil Monitoring: – Facility DD&D and MDA and PRS remediation would have a positive impact by removing or containing legacy contamination. Soil Erosion: – Activities could impact approximately 3.2 million cubic yards (2.5 million cubic meters) of soil and rock. – Standard best management practices would serve to minimize soil erosion and loss. Mineral Resources: – MDA remediation would have a significant impact on geological resources -- up to 2.5 million cubic yards (1.9 million cubic meters) of crushed tuff and other materials would be required under the Capping Option. – Up to 1.4 million cubic yards (1.1 million cubic meters) of crushed tuff and other materials would be required under the Removal Option. – Materials would be available at LANL or from nearby offsite sources. – TA-61 borrow pit would be expanded. Security Driven Transportation Modifications: – Would disturb up to 238,000 cubic yards (182,000 cubic meters) of soil and rock for construction. – Construction of bridges could disturb up to 26,000 cubic yards (20,000 cubic meters) of soil and rock. – Excavated materials would be managed to minimize erosion and losses.
Affected Technical Areas			
TA-3	No impacts to geology and soils.	Same as No Action Alternative	Same as No Action Alternative except: – Construction of Replacement Office Buildings and Center for Weapons Physics Research would impact approximately 868,000 cubic yards (664,000 cubic meters) of soil and rock for building excavation. – Excavated materials would be managed to minimize erosion and losses; backfill for DD&D buildings would be obtained at LANL or from nearby offsite sources. – Legacy contamination would be reduced due to removal of contaminated soils during DD&D.
TA-21	No impacts to geology and soils	Same as No Action Alternative	Same as No Action Alternative except: – No impact to native soils because all areas were disturbed previously by site activities. – Positive impact due to removal or improved containment of contaminated soils as a result of MDA remediation and DD&D of existing structures.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
TA-61	No impacts to geology and soils	Same as No Action Alternative	Same as No Action Alternative, except: – If all MDA Capping Option tuff requirements came from TA-61, 25 acres (10 hectares) would have to be excavated an average of 50 feet (15 meters). – If all MDA Removal Option tuff requirements came from TA-61, 25 acres (10 hectares) would have to be excavated an average of 33 feet (10 meters).
TA-72	No impacts to geology and soils	Same as No Action Alternative	Same as No Action Alternative, except: – Construction of Remote Warehouse and Truck Inspection Station would impact about 90,000 cubic yards (69,000 cubic meters) of soil and rock for building excavation. – Excavated materials would be managed to minimize erosion and losses; backfill for DD&D buildings would be obtained at LANL or from nearby offsite sources. – Negative impact in the areas where construction would impact undisturbed native soils.
Key Facilities			
Pajarito Site DD&D (TA-18)	No impacts to geology and soils	Same as No Action Alternative	Same as No Action Alternative, except: – No impact to native soils because all areas were disturbed previously. – Positive impact due to removal of contaminated soils and reduction of legacy soil contamination at LANL.
Radiochemistry Facility (TA-48)	No impacts to geology and soils	Same as No Action Alternative	Same as No Action Alternative, except: – DD&D of existing facilities would reduce legacy contamination and potential soil erosion. – Construction of Radiological Sciences Institute would impact approximately 802,000 cubic yards (613,000 cubic meters) of soil and rock for building excavation, some up to 45 feet (14 meters) below grade. – Excavated materials would be managed to minimize erosion and losses; backfill for DD&D buildings would be obtained at LANL or from nearby offsite sources. – Negative impact in the areas where construction would impact undisturbed native soils.
Radioactive Liquid Waste Treatment Facility (TA-50 and TA-54)	No impacts to geology and soils	Same as No Action Alternative	Same as No Action Alternative, except: – Construction would impact about 95,000 cubic yards (72,000 cubic meters) of soil and rock for building excavation. – Construction of evaporation basins would impact approximately 80,000 cubic yards (61,000 cubic meters) of soil and rock. – Excavated materials would be managed to minimize erosion and losses; backfill for DD&D buildings would be obtained at LANL or from nearby offsite sources. – DD&D of North or South Annexes would reduce legacy contamination and potential soil erosion. – Negative impact in the areas where construction would impact undisturbed native soils.
Bioscience Facilities	No impacts to geology and soils	Same as No Action Alternative	Same as No Action Alternative, except: – Construction of Science Complex would impact about 865,000 cubic yards (661,000 cubic meters) of soil and rock for building excavation. – Excavated materials would be managed to minimize erosion and losses; backfill for DD&D buildings would be obtained at LANL or from nearby offsite sources. – Negative impact in the areas where construction would impact undisturbed native soils.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Solid Radioactive and Chemical Waste Facilities (TA-50 and TA-54)	No impacts to geology and soils	Same as No Action Alternative	Same as No Action Alternative, except: – Waste Management Facilities transition would impact up to 169,000 cubic yards (130,000 cubic meters) of soil and rock for building excavation and construction. Option 1 (Accelerated Actions) would impact approximately 80,000 cubic yards (61,000 cubic meters) and Option 2 (Interim Actions) would impact up to 89,000 cubic yards (68,000 cubic meters), depending on whether Option 2a, 2b, or 2c were selected. – No impact to native soils because all areas were disturbed previously. – Positive impact due to removal of wastes, contaminated soils and reduction of legacy soil contamination at LANL. – Excavated materials would be managed to minimize erosion and losses; backfill would be obtained at LANL or from nearby offsite sources.
Radiography Facility (TA-55)	No impacts to geology and soils	Same as No Action Alternative	Same as No Action Alternative, except: – Construction of the New Radiography Building would impact up to 9,500 cubic yards (7,300 cubic meters) of soil and rock for building excavation. – No impact to native soils because all areas were disturbed previously. – Positive impact due to removal of contaminated soils and reduction of legacy soil contamination at LANL. – Excavated materials would be managed to minimize erosion and losses; backfill would be obtained at LANL or from nearby offsite sources.

DD&D = decontamination, decommissioning, and demolition; MDA = material disposal area; PRS = potential release site, TA = technical area.

5.2.1 No Action Alternative

Los Alamos National Laboratory Site-Wide Impacts

Volcanism and Seismic Activity

LANL operations under the No Action Alternative do not include activities (such as underground nuclear tests or operation of injection wells) that could modify the movement of magma, trigger volcanic activity, or increase the probability of seismic events. This is unchanged from the *1999 SWEIS* impact analysis (DOE 1999a). The estimated level of seismic hazard in use at present is based on the 1985 probabilistic seismic hazard assessment referenced in the *1999 SWEIS*. This assessment is being updated to reflect continuing studies of the seismic and structural setting at LANL as well as a comprehensive review of existing data and those collected since the 1985 assessment (LANL 2004e). The update is expected to be completed in the fourth quarter of 2006. This is a periodic update of the seismic assessment for LANL; it is not related to any changes in LANL activities or the alternatives discussed herein.

Slope Stability, Subsidence, and Soil Liquefaction

The No Action Alternative does not include any new activities that would result in additional slope stability impacts. This is unchanged from the *1999 SWEIS* impact analysis (DOE 1999a). The potential for slope failure under this Alternative is related primarily to increased stream downcutting, which may be the result of greater streamflow. The No Action Alternative does not include activities that would significantly increase streamflow, such as startup of new facilities or use of new industrial processes that discharge large volumes of water. Similarly, this alternative does not include any activities that would increase surface subsidence or the potential for soil liquefaction.

Soil Monitoring

The No Action Alternative does not include any activities that would increase the level of legacy contaminants (both chemical and radiological) in soils at the site. As discussed in Section 4.2.3.1, the levels of legacy contaminants are generally decreasing over time, a reflection of contaminant decay, soil losses, and improvements in LANL work practices and environmental management.

Soil Erosion

The No Action Alternative does not include any activities that would significantly impact the potential for soil erosion. Construction activities yet to be undertaken under the No Action Alternative would continue to use standard mitigation measures to minimize the effect of surface runoff and erosion.

Mineral Resources

The No Action Alternative would not affect the mineral resources in use at LANL. As discussed in Section 4.2.4, the potential mineral resources at LANL are sand, gravel, tuff, and pumice deposits. These materials can be used for backfill or construction of evapotranspiration covers for environmental remediation projects. Under the No Action Alternative, the areas for proposed

new construction activities are relatively small and would not impede the availability of borrow material. The only area being used for mineral resources, the East Jemez Road Borrow Pit in TA-61 (Stephens and Associates 2005) would continue to be available under the No Action Alternative. However, at present the pit is being used to stockpile and manage materials from other areas and no quarrying is being conducted.

Technical Area Impacts

No activities planned to be undertaken under the No Action Alternative are expected to additionally impact geology and soils at any of the technical areas.

Key Facilities

No activities planned to be undertaken under the No Action Alternative with respect to the construction or operations of any of the site's Key Facilities are expected to additionally impact geology and soils.

5.2.2 Reduced Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Geology and soils impacts under the Reduced Operations Alternative would be similar to those expected under the No Action Alternative.

Technical Area Impacts

Geology and soils impacts under the Reduced Operations Alternative with respect to the technical areas would be similar to those expected under the No Action Alternative.

Key Facilities

High Explosives Testing

The potential impact of LANL operations on soil contamination could decrease under the Reduced Operations Alternative due to a 20 percent reduction in activities at the high explosives testing facilities as compared to the No Action Alternative.

5.2.3 Expanded Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Similar to the impacts expected under the No Action Alternative, LANL operations under the Expanded Operations Alternative would not be expected to impact the site with respect to volcanism, seismic activity, slope stability, subsidence, or soil liquefaction. Proposed activities (including facility construction and DD&D) would not significantly alter overall LANL subsurface conditions.

Volcanism and Seismic Activity

All proposed new facilities would be designed, constructed, and operated in compliance with the applicable DOE Orders, requirements, and governing standards that have been established to protect public and worker health and the environment. DOE Order 420.1B (DOE 2005d) requires that nuclear or nonnuclear facilities be designed, constructed, and operated so that the public, the workers, and the environment are protected from the adverse impacts of natural phenomena hazards, including earthquakes. The Order stipulates the natural phenomena hazards mitigation requirements for DOE facilities and specifically provides for the reevaluation and upgrade of existing DOE facilities when there is a significant degradation in the safety basis for the facility. DOE Standard 1020-2002 (DOE 2002a) implements DOE Order 420.1B and provides criteria for the design of new structures, systems, and components and for evaluation, modification, or upgrade of existing structures, systems, and components so that DOE facilities safely withstand the effects of natural phenomena hazards such as earthquakes. The criteria specifically reflect adoption of the seismic design and construction provisions of the International Building Code for DOE Performance Category 1 and 2 facilities.

Slope Stability, Subsidence, and Soil Liquefaction

Similar to the No Action Alternative, the Expanded Operations Alternative does not include any new activities that would result in additional slope stability impacts. This Alternative does not include activities that would significantly increase streamflow, such as startup of new facilities or use of new industrial processes that discharge large volumes of water. Similarly, this Alternative does not include any activities that would increase surface subsidence or the potential for soil liquefaction. All new facilities to be built under this alternative would be located at sufficient distance from steep slopes (such as canyon walls) and would use standard construction practices to minimize the potential for slope failure.

Soil Monitoring

This alternative would decrease the level of legacy contamination at facility construction, DD&D, and MDA remediation sites. At these sites, excavated soil and rock would be monitored for contamination. Any contaminated materials would be managed according to the LANL environmental restoration and waste management programs. The overall effect would be to remove contaminated soil from LANL, thereby reducing the levels of legacy contamination onsite. The impact of removal would be much greater under the Expanded Operations Alternative than the No Action or Reduced Operations Alternatives due to the greater volume of soil to be excavated, monitored, and potentially removed as contaminated media.

At sites involving excavation or other soil disturbances, the potential does exist for PRSs and PRS affected areas to be impacted. Prior to commencing any ground disturbance, potentially affected contaminated areas would be surveyed to determine the extent and nature of any contamination and required remediation in accordance with procedures established under the LANL Risk Reduction and Environmental Stewardship Remediation Program.

Soil Erosion

Under the Expanded Operations Alternative, facility construction and DD&D would impact geological materials. A total of approximately 3.4 million cubic yards (2.6 million cubic meters) of soil and rock would be impacted; however, over 90 percent of the material would be from areas disturbed by present or past activities, minimizing the loss of native soils. The impact would include both the facility footprint and support areas, such as soil staging areas and construction equipment laydown yards.

Surface soils and unconsolidated sediments exposed in excavations would be subject to wind and water erosion if left exposed over an extended period of time. In all instances, adherence to standard best management practices for soil erosion and sediment control, including watering during construction, would serve to minimize soil erosion and loss. After construction, disturbed areas that have not been paved would be stabilized and/or revegetated and would not be subject to long-term soil erosion.

Mineral Resources

Proposed actions under the Expanded Operations Alternative would significantly impact mineral resources at LANL. The impacts are due to proposed closures of the MDAs under the Consent Order[1] (NMED 2005) through either waste containment via construction of evapotranspiration covers or waste removal by excavation and offsite disposal. If final covers were constructed at the MDAs under the Capping Option, 750,000 to 2,000,000 cubic yards (570,000 to 1,500,000 cubic meters) of crushed tuff would be needed through 2016 depending on the required thickness of the covers. Up to 460,000 cubic yards (350,000 cubic meters) of additional rock, gravel, topsoil, and other bulk materials would be required for the final surface and erosion control. Impact to soil and rock from possible construction of vertical and subsurface horizontal containment walls would be minor.

If the waste were removed under the Removal Option, approximately 1,300,000 cubic yards (1,000,000 cubic meters) of backfill would be needed to replace the excavated waste and contamination, as well as 61,000 cubic yards (47,000 cubic meters) of rock, gravel, topsoil, and other bulk materials for erosion control and site restoration.

For economic and feasibility reasons, these materials would need to be produced from borrow pits and quarries in the LANL area (Stephens and Associates 2005). The only borrow pit now in use at LANL is the East Jemez Road Borrow Pit in TA-61. There would be sufficient tuff available for quarrying at the pit to provide the needed volumes of crushed tuff. Other sources available in the area would be required to provide other materials (such as soil and coarse material for erosion control) needed to complete the MDA remediation. Borrow materials could also be collected from areas of opportunity on the site, such as facility construction or DD&D areas where excess uncontaminated excavated soils may meet backfill or capping criteria. The use of excavated soils as fill or cap material would minimize the need for additional borrow pits

[1] NNSA is not legally obligated to include the Consent Order impacts analysis, but for purposes of this SWEIS, NNSA is including this information in support of collateral decisions that NNSA may make to facilitate implementation of Consent Order activities.

and the impact to LANL soils, surface water, and potential impact to groundwater from enhanced infiltration.

Security Driven Transportation Modifications

The proposed Security-Driven Transportation Modifications would disturb up to 238,000 cubic yards (182,000 cubic meters) of soil and rock during construction. In addition, construction of optional bridges under this proposal could disturb up to 26,000 cubic yards (20,000 cubic meters) of soil and rock.

Technical Area Impacts

Technical Area 3

Construction of Replacement Office Buildings and the Center for Weapons Physics Research would impact about 874,000 cubic yards (668,000 cubic meters) of soil and rock for building excavation. DD&D of existing facilities would reduce legacy contamination and potential soil erosion. Excavated materials would be managed to minimize erosion and losses and backfill for DD&D buildings would be obtained at LANL or from nearby offsite sources. There would be a negative impact on areas where construction would impact undisturbed native soils.

Technical Area 21

Remediation of MDAs A, B, T, and U, and DD&D of structures would take place in areas already disturbed by site activities so there would be no impact on native soils. Additional fill materials would be obtained onsite or from nearby offsite sources. Completion of DD&D and MDA remediation would result in a positive impact due to the removal of contaminated soils from the site and a reduction of legacy soil contamination at LANL.

Technical Area 61

As discussed above, the only borrow pit now in use at LANL is the East Jemez Road Borrow Pit in TA-61. The site containing the borrow pit currently covers approximately 43 acres (17 hectares). If all of the tuff materials required to support the MDA Capping Option at maximum thickness were taken from this borrow pit, 25 acres (10 hectares) of the pit would have to be excavated an average of 50 feet (15 meters). Under the MDA Removal Option, about 65 percent of the Capping Option maximum tuff requirement would be needed; thus, the TA-61 borrow pit would only need to be excavated an average of 33 feet (10 meters) over 25 acres (10 hectares).

Technical Area 72

Construction of the Remote Warehouse and Truck Inspection Station would require excavation of approximately 90,000 cubic yards (69,000 cubic meters) of soil and some of the underlying rock. The facility would be constructed in previously undisturbed areas, resulting in a negative impact due to the loss of native LANL soils. During construction, the excavated soil and rock would be managed to minimize erosion and losses. If necessary, backfill material would be obtained from LANL sources.

Key Facilities

Pajarito Site

DD&D and shutdown activities would impact approximately 223,000 cubic yards (170,000 cubic meters) of soil and rock. There would be no impact to native soils because all areas were previously disturbed. After DD&D and shutdown were complete, there would be a positive impact due to the removal of contaminated soils from the site and a reduction of legacy soil contamination at LANL.

Bioscience Facilities

Construction of the Science Complex would impact about 865,000 cubic yards (661,000 cubic meters) of soil and rock for building excavation. Although a similar volume of earthwork would be required under each of the three options for building this facility, the impact to native (undisturbed) LANL soils would depend on the option selected. Option 1 (Northwest TA-62 Site) and Option 2 (Research Park Site) would have the greater impact on LANL soils because the complex would be built in a relatively undeveloped area, resulting in excavation and disruption of the native soil material. Option 3 (South TA-3 Site) would have a lesser impact on native LANL soils because the facility would be placed on an area presently occupied by a parking lot and on fill material previously placed at the site. There would be some impact to native LANL soils along the margins of facility construction under Option 3.

The accompanying DD&D of a similar square footage of existing facilities would reduce legacy contamination and potential soil erosion. Materials excavated for facility construction and DD&D would be managed to minimize erosion and losses. Backfill for facility construction or DD&D would be obtained from LANL sources.

Radiochemistry Facility

Construction of the Radiological Sciences Institute would impact about 802,000 cubic yards (613,000 cubic meters) of soil and rock for building excavation. DD&D of existing facilities would reduce legacy contamination and potential soil erosion. Excavated materials would be managed to minimize erosion and losses and backfill for DD&D buildings would be obtained at LANL or from nearby offsite sources. There would be a negative impact on areas where construction would impact undisturbed native soils.

Radioactive Liquid Waste Treatment Facility

Construction of a Radioactive Liquid Waste Treatment Facility (RLWTF) would impact about 80,000 cubic yards (61,000 cubic meters) of soil and rock for building excavation. In addition, another approximately 84,000 cubic yards (64,000 cubic meters) of soil and rock would be impacted as a result of construction of evaporation basins. DD&D of the North or South Annexes would reduce legacy contamination and potential soil erosion. Excavated materials would be managed to minimize erosion and losses and any additional backfill that may be required would be obtained at LANL or from nearby offsite sources. There would be a negative impact on areas where construction would impact undisturbed native soils.

Solid Radioactive and Chemical Waste Facilities

Waste Management Facilities Transition activities primarily would involve work within TA-54, TA-50, and TA-63. From 80,000 to 169,000 cubic yards (61,000 to 130,000 cubic meters) of soil and rock would be impacted due to earthmoving operations; the total volume impacted would depend on the combination of Option 1 and Option 2a, 2b, or 2c. Option 1 (accelerated removal and disposition of wastes with supporting removal, re-location, and replacement of applicable facilities) would impact approximately 80,000 cubic yards (61,000 cubic meters) of rock and soil. Option 2 (Interim Actions Necessary for Meeting Consent Order and Other Options) impacts would be in addition to those under Option 1. Option 2a would impact approximately 89,000 cubic yards (68,000 cubic meters) of additional soil and rock for facility construction; Option 2b would impact approximately 82,000 cubic yards (63,000 cubic meters) and Option 2c would have a negligible impact on soil and rock because no additional facility would be constructed.

There would be minimal loss of native LANL soils because the activities would occur in areas previously disturbed by LANL activities. During construction, excavated soil and rock would be managed to minimize erosion and losses. If necessary, backfill material would be obtained from LANL sources. The necessary backfill volume would not significantly deplete geological resources at LANL. There would be a positive impact through the removal of wastes and contaminated soil from LANL, as well as a reduction in legacy soil contamination.

TA-55 Radiography Facility

Relocation of high-energy x-ray radiography into a TA-55 Radiography Facility would impact up to 8,000 cubic yards (6,100 cubic meters) of soil and rock for building reconfiguration and upgrades. The actual amount of material disturbed would depend on the option selected. Option 1 (construction of the New Radiography Facility) would result in disturbance of the largest volume of soil and rock, cited above. Option 2 (Hybrid Option) would disturb approximately 9,500 cubic yards (7,300 cubic meters) of soil and rock, and Option 3 (Renovation Option) would disturb approximately 2,100 cubic yards (1,600 cubic meters) of soil and rock. In each case, the construction would be within and adjacent to the existing building, so there would be no impact to native LANL soils. During construction, best management practices would be implemented to prevent erosion and migration of disturbed materials from the site caused by storm water or other water discharges or wind. Uncontaminated backfill would be stockpiled at an approved material management area at LANL for future use.

5.3 Water Resources

Water resource impacts that are considered in this section include changes in surface water quality and quantity, sediments, floodplains, and groundwater quality and quantity.

5.3.1 Surface Water

Surface water quality is measured using sampling data from National Pollutant Discharge Elimination System (NPDES) outfalls, storm water flows, and watershed monitoring stations. As it is difficult to predict future sampling results, a qualitative analysis of actions that could affect those results was performed based upon patterns observed from previous actions. For

example, the effect of installing a new treatment system at the RLWTF would be an expected reduction in the number of samples with constituents that exceed NPDES permit requirements. Thereafter, samples from short-lived and intermittent streams downgradient of that facility's outfall could be expected to have reduced concentrations of the removed contaminant after a few years. The effect may not be immediate if effluents are diluted by perennial or storm water flows, but the long-term effect would be improved surface water quality in that canyon. This type of beneficial impact would be significant.

A potential source of surface water contamination is the sediment located in certain canyon bottoms. Sampling results following the Cerro Grande Fire showed that unusually large volumes of storm water could mobilize contaminants in sediment and transport them for long distances downstream. Actions that could increase surface water volumes would be likely to mobilize contaminated sediment, potentially adversely affecting surface water quality.

Surface disturbance from construction activities have the potential to remove protective vegetative or other earth cover, loosen soil particles, and generate accelerated erosion that could result in sedimentation entering the waterways. For this analysis, it was assumed that accelerated erosion from surface disturbance during construction would be minimized by the installation and maintenance of erosion and sediment controls, in compliance with State and Federal regulations under the Clean Water Act, including the NPDES Construction General Permit and Section 404 and Section 401 permits.

Storm water volumes could be directly affected by LANL construction due to changes in the size of impervious areas that affect runoff flow rates and volumes. Changes in LANL effluent discharges from the NPDES outfalls can affect the quantity of flow in sections of the canyons. The surface water flows in various canyons could be affected if some of the flood structures from the Cerro Grande Fire were removed.

While the acreage of impervious area of LANL facilities to be constructed in each watershed is needed to calculate changes in runoff volume under each alternative, the proposed facility designs are not developed to the point where the footprint size of the facilities is usable for that purpose. Storm water management is required to be implemented as part of LANL's construction specifications (LANL 2004d). For this analysis, it was assumed that new construction would include installing construction site storm water controls, so there would not be an increase in peak surface water runoff reaching the canyons. Therefore, increased runoff from additional impervious surfaces was not considered in the impact analysis.

The environmental consequences of LANL actions under the different alternatives could impact surface water quality, surface water quantity, floodplains and wetlands, and sediments. Impacts on wetlands are discussed in Section 5.5 because they are an important habitat for diverse flora and fauna. **Table 5–4** summarizes the expected surface water impacts for each of the three alternatives.

Table 5–4 Summary of Environmental Consequences on Surface Water

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site			
	Land Transfer: − Negligible impact on surface water quality and floodplains (White Rock Y and Rendija Canyon). Wildfire Hazard Reduction Program − Minor impact on surface water quality, quantity, and floodplains. Beneficial long-term effects due to wildfire risk reduction. Flood Structures Removal: − Minor beneficial impact on surface water quality and quantity. − Temporary adverse impact on Pajarito floodplains due to removal of structures that retained flow and sediment. Restoration of normal flow would cause sediments to alter channel and readjust floodplains. Security Perimeter Project − Minor impact on surface water quality if soil contaminants mobilized. MDA Remediation − Not applicable	Same as No Action Alternative	Same as No Action Alternative Same as No Action Alternative Same as No Action Alternative Same as No Action Alternative Actions taken in compliance with the Consent Order with respect to MDA remediation would ensure water quality is protected (long-term) by removal or stabilization of potential contamination sources.
TAs			
TA-21	No impact on surface water quality.	Same as No Action Alternative	DD&D of the Steam Plant and the Tritium Science and Fabrication Facility would result in removal of two NPDES-permitted outfalls. Minor impact on surface water quantity in Los Alamos Canyon, but little to no impact on surface water quality.
TA-46	Minor impact on surface water quality and quantity in Sandia Canyon from recycling Sanitary Wastewater Systems Plant outfall volume for use in cooling towers.	Same as No Action Alternative	Same as No Action Alternative

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Key Facilities			
High Explosives Testing Facility – Dynamic Operations Complex	No impact on surface water quality.	Minor impact on surface water quantity in Water Canyon due to reduction of operations. Minor beneficial impact on surface water quality by discharge reduction.	Same as No Action Alternative.
Radioactive Liquid Waste Treatment Facility (TA-50)	No impact on surface water quality.	Same as No Action Alternative	Volume of water in Mortandad Canyon greatly reduced and surface water quality would be improved.
LANSCE (TA-53)	No impact on surface water quality.	Effects may be temporary or permanent, if shut down. Beneficial impacts in Los Alamos Canyon due to shutdown of operations and removal of two NPDES – permitted outfalls.	Same as No Action Alternative.
Pajarito Site (TA-18)	No impact on surface water quality.	Same as No Action Alternative.	DD&D would have minor beneficial impact on surface water quality by removing potential contaminant sources. Minor impact to Pajarito Canyon floodplains by removing TA-18-184 building obstruction.

MDA = material disposal area, TA = technical area, DD&D = decontamination, decommissioning, and demolition, NPDES = National Pollutant Discharge Elimination System, LANSCE = Los Alamos Neutron Science Center.

LANL NPDES outfall volumes affect surface water quantities and could be altered by proposed LANL activities. Although direct impacts from changes to effluent discharges are usually localized to a short section within a canyon, such changes could affect the entire downstream drainage system. Changes to effluent discharges under each alternative were compared to the baseline for NPDES outfall volumes in each canyon, calculated from the totalized or estimated average flows from 2001 through 2004. **Table 5–5** summarizes the estimated outfall volumes for the three alternatives evaluated. The assumptions used to calculate the projected changes in outfall volumes for each alternative are listed at the end of Table 5–5.

Changes in outfall volume within a canyon of less than 5 percent of current flows are considered negligible, and changes of more than 40 percent are considered significant. The threshold for significance using a percent change in outfall contributions of greater than 40 percent was selected to provide a measure of change specifically for this SWEIS, based on past changes that made a difference to water quality and quantity. In those canyons where flows are typically relatively low, it is predicted that outfall changes would affect both water quality and quantity downstream.

5.3.1.1 No Action Alternative

Los Alamos National Laboratory Site-Wide Impacts

In order to reduce the potential impacts of LANL activities on water resources, LANL has several programs that monitor and protect surface water quality and quantity. Under the No Action Alternative, the NPDES industrial permit would be modified to reduce the total number of outfalls from 21 to 17. The four outfalls that would be removed from the permit in 2006 have not discharged effluent in recent years, so no direct impacts to water quality or flow volumes in the canyons would result.

When the NNSA determines that site conditions have returned to pre-Cerro Grande Fire conditions, the aboveground portion of the flood retention structure and the entire steel diversion wall upgradient of TA-18 would be removed in the Flood Structures Removal Project (DOE 2002i). Best management practices would be implemented during the controlled demolition and removal of the flood control structures to control disturbed sediment that might enter the water course during construction. No excavation or demolition debris would be placed in or near drainages or in the Pajarito Canyon floodplain, so the potential for surface water contamination after construction would be minimal (DOE 2002i). After removal of the flood control structures in Pajarito Canyon is completed, there would be increased potential for sediment transport in the short term, as the channel adjusts to the change (LANL 2002b).

Continued maintenance of the low-head weir and detention basin in Los Alamos Canyon and the road reinforcements above Pajarito, Twomile, Los Alamos, and Water Canyons would minimize adverse impacts to surface water quality and the floodplains in those canyons even if the Flood Structures Removal Project is implemented. Long-term stabilization at the sites of the removed structures using recontouring and reseeding would protect surface water quality in Pajarito Canyon. Sediment and water sampling in the canyons would monitor potential contamination and trigger remedial actions, if needed (DOE 2002i).

Table 5–5 Estimated National Pollutant Discharge Elimination System Permitted Discharges by Facility and Canyon (million gallons per year)

Facility	*No Action Alternative*	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Los Alamos Canyon			
Tritium Facility – 2 outfalls	17.4	17.4	0.0 [a]
LANSCE – 3 outfalls	28.2	0.0 [b]	28.2
Canyon Total	45.6	17.4	28.2
Sandia Canyon			
Sigma Complex – 1 outfall	0.0 [c]	0.0 [c]	0.0 [c]
LANSCE – 1 outfall	1.3	0.0 [b]	1.3
Nicholas C. Metropolis Center for Modeling and Simulation (Metropolis Center) – 1 outfall	13.6	13.6	17.7 [d]
Non-Key Facilities – 3 outfalls	172.4	172.4	172.4
Canyon Total	187.3	186.0	191.4
Mortandad Canyon			
Chemistry and Metallurgy Research Building –1 outfall	2.1	2.1	2.1
Sigma Complex – 1 outfall	5.8	5.8	5.8
Plutonium Complex– 1 outfall	4.0	4.0	4.0
Radioactive Liquid Waste Treatment Facility– 1 outfall	4.4	4.4	5.5 [e]
Non-Key Facilities – 1 outfall	28.5	28.5	28.5
Canyon Total	44.8	44.8	45.9
Water Canyon (including Cañon de Valle)			
High Explosives Processing – 3 outfalls	0.06	0.05 [f]	0.06
High Explosives Testing – 2 outfalls	2.2	1.8 [g]	2.2
Canyon Total	2.26	1.81	2.26
Subtotal Key Facilities (including the Metropolis Center)	79.1	49.1	66.8
Non-Key Facilities	200.9	200.9	200.9
Totals	280.0	250.0	267.7

LANSCE = Los Alamos Neutron Science Center.
Assumptions used to predict outfall volumes:
[a] Zero discharge based upon removal of TA-21 buildings including the Steam Plant Outfall and the Tritium Science and Fabrication Facility Outfall.
[b] Zero discharge based upon safe shutdown of LANSCE.
[c] This outfall has not discharged any effluents in recent years and has been proposed for removal from the National Pollutant Discharge Elimination System permit.
[d] 30 percent increase in cooling water based upon operation of a third cooling tower.
[e] 25 percent increase based upon increased activity of facilities that generate radioactive liquid waste.
[f] 20 percent decrease based upon 20 percent reduction in high explosives processing.
[g] 20 percent decrease based upon 20 percent reduction in high explosives testing.
Note: To convert gallons to liters, multiply by 3.78533. Totals may not add due to rounding.
Sources: EPA 2001, LANL 2006.

The removal of fuels through the Wildfire Hazard Reduction Program would improve forest health, stabilize the watersheds, and reduce the long-term potential for wildfires. This would have a beneficial impact on surface water quality, as wildfires destroy the vegetation that stabilizes the soil and promotes storm water infiltration. With fewer wildfires, there would be less potential for increased storm water runoff to erode soil and mobilize contaminants (DOE 2000e), reducing the potential for surface water contamination from high sediment loads in storm water. Reducing wildfire potential would also limit other adverse impacts to surface water quality such as scoured stream channels that alter the extent of floodplains. Potentially adverse impacts resulting from tree cutting, chipping, and slash pile burning in the floodplains performed as part of the Wildfire Hazard Reduction Program would be mitigated through required environmental protection measures (DOE 2000e).

Construction activities associated with the Security Perimeter Project (DOE 2003a; NNSA 2004a, 2005a) could require compliance with Section 404 and Section 401 permits, thereby requiring provisions to protect the watercourse from potential increased runoff and sediments during bridge construction. Adverse impacts on surface water quality due to construction on the canyon walls and access control and traffic improvements near the watercourse would be minimized through the implementation of a storm water pollution plan to control soil erosion in accordance with the NPDES Construction General Permit. Such best management practices could include the use of silt fences, straw bales, and check dams.

The Security Perimeter Project would have a minor beneficial effect on surface water quality if the PRSs at solid waste management units located in the proposed bypass road corridors were remediated, due to the removal of contaminants found in the drainage pathway from a chemical (polychlorinated biphenyls) storage area and the outfalls. There would be a negligible adverse effect from increased storm water runoff over the new impervious road surfaces that would allow additional flows containing potential contaminants.

Technical Area Impacts

NPDES permitted outfalls would be maintained at four Non-Key Facilities—the TA-3 Power Plant (001); the TA-3 Laboratory Data Computing Center cooling tower outfall (03A199); the Sanitary Wastewater Systems Plant at TA-46 (13S), which routes its effluent through storage tanks at TA-3 for recycling or discharge; and a cooling tower outfall at TA-35 (03A160). Total effluent discharges from these outfalls would continue to be lower than the 1999 actual volumes, although individual facilities could have higher volumes. The TA-46 Sanitary Wastewater System Plant would have a minor beneficial impact on surface water quality and quantity in Sandia Canyon due to reduced NPDES outfall volumes and associated contaminants from the implementation of the effluent recycling project for cooling towers at the Metropolis Center (LANL 2006).

Key Facilities Impacts

Sigma Complex

At the Sigma Complex, one cooling tower NPDES outfall (03A024) would be removed (LANL 2006). There has been no flow from this outfall in recent years, so flow volumes in

Mortandad Canyon where this effluent discharged would not be affected. The Sigma Complex would retain a separate cooling water outfall into Sandia Canyon (03A022) (LANL 2006).

High Explosives Processing

At the High Explosives Processing Facility, one NPDES outfall (05A097) would be removed (LANL 2006). There has been no flow from this outfall in recent years, so flow volumes in Water Canyon, where this effluent discharged in the past, would not be affected. The high explosives outfall from the High Explosives Wastewater Treatment Facility (05A055) at TA-16 and the cooling water outfall (03A130) at TA-11 would continue discharging treated effluent into Water Canyon (LANL 2006).

High Explosives Testing

At the High Explosives Testing Facility, implementation of the Dynamic Operations Complex Enhanced Containment would reduce potential impacts to surface water quality from depleted uranium contamination by containing 75 percent of experimental material from shots (LANL 2001d). Enhanced containment of shot debris and augmented cleanup of debris from uncontained shots would have a minor long-term beneficial effect on water quality by reducing the potential contaminants that could be mobilized by storm water.

Los Alamos Neutron Science Center

At the Los Alamos Neutron Science Center (LANSCE), a project to upgrade the cooling towers would result in a reduction in the number of cooling tower outfalls at the facility from four to two. There has been no flow from the older cooling towers in recent years, so flow volumes in Los Alamos Canyon would not be affected.

5.3.1.2 Reduced Operations Alternative

Most impacts on surface water quality and quantity from those actions discussed under the No Action Alternative would still take place under the Reduced Operations Alternative, except those explicitly associated with the reduced ordinance operations.

Key Facility Impacts

Under the Reduced Operations Alternative, impacts to surface water quality would be the same as described under the No Action Alternative with the exception of those impacts described below. There would be little or no effect on floodplains from changes to Key Facilities.

High Explosives Processing

Reduced operations at the High Explosives Processing Facilities would have little or no effect on surface water quality or quantity. Effluent volumes from the High Explosives Wastewater Treatment Facility (05A055) and the cooling water (03A130) NPDES outfalls would be reduced by about 20 percent, but their expected flows of less than 0.05 million gallons per year (0.2 million liters), or less than 3 percent of the total effluent discharged in Water Canyon, are not large enough to result in significant beneficial impacts to surface water.

High Explosives Testing

Reduced operations at the High Explosives Testing Facilities would result in minor beneficial effects on local surface water quality and quantity. Expected effluent flows from the cooling water NPDES outfalls (03A028 and 03A185) into Water Canyon would be reduced about 20 percent from 2.2 million gallons (8.3 million liters) per year to about 1.8 million gallons (6.7 million liters) per year. The percentage change in flow volumes from these reduced operations would not exceed the significance threshold for surface water quantity in Water Canyon.

Los Alamos Neutron Science Center

Surface water impacts from shutting down operations at the LANSCE Facility may be short-term or permanent. Shutdown of the LANSCE facility would result in a significant change to surface water quantity in Los Alamos Canyon compared to the No Action Alternative. Cooling water NPDES outfalls from LANSCE contribute about 60 percent of the effluent flowing into Los Alamos Canyon. The shut down of the LANSCE facility would also slightly affect Sandia Canyon; the change would be approximately 1 percent less effluent flow than under the No Action Alternative. In both canyons, this would have a beneficial impact on surface water quality in Los Alamos Canyon, because reduced flows would potentially mobilize fewer contaminated sediments.

5.3.1.3 Expanded Operations Alternative

Surface water quality and quantity impacts from those actions discussed under the No Action Alternative would still take place under the Expanded Operations Alternative.

Los Alamos National Laboratory Site-Wide Impacts

There would be beneficial impacts to surface water quality following remediation of the MDAs. Construction of MDA final covers under the Capping Option or removal operations under the Removal Option would disturb soils and remove stabilizing vegetation temporarily. In compliance with the terms of the NPDES Construction General Permit, installation of erosion control measures described in a storm water pollution prevention plan would minimize erosion and offsite sedimentation during construction.

Following closure of the MDAs, surface water quality would gradually improve as corrective measures remove or stabilize potential sources of contamination from release sites (see Appendix I). The Capping Option and the Removal Option would decrease the risk of surface water contamination even more than the No Action Alternative, because more potential contamination sources at the MDAs would be stabilized or removed (see Appendix I).

Technical Area Impacts

DD&D of buildings at TA-21 would eliminate both the Tritium Science and Fabrication Facility and the Steam Plant, which both discharge industrial effluent into Los Alamos Canyon. As these are the only TA-21 outfalls, discharges from this TA would be eliminated in the Expanded Operations Alternative. The impact on surface water quantity in Los Alamos Canyon would be

minor, as these effluents are less than 40 percent of the discharges into that canyon. Removal of these contaminant sources would have little to no impact on surface water quality, because the majority of the effluent comes from boiler blowdown and cooling water, which does not have many contaminants.

Key Facilities Impacts

Under the Expanded Operations Alternative, impacts to surface water quality would be the same as described under the No Action Alternative, except as described below. Construction of a new RLWTF, two bridges, other building construction, and demolition of the existing annexes would have little or no adverse impact on surface water quality, due to the installation of storm water management and erosion and sediment controls based on compliance with a site-specific storm water pollution prevention plan and LANL's construction specifications.

Radioactive Liquid Waste Treatment Facility

Proposed increased discharges from the RLWTF outfall as a result of increased activity at facilities that generate radioactive liquid waste (see Table 5–5) would result in about 2.5 percent higher effluent discharge rate into Mortandad Canyon, compared to the No Action Alternative. RLWTF effluent currently accounts for about 12 percent of the discharges into Mortandad Canyon and this percentage of overall flow contribution to the canyon would increase in the future. Contaminant transport through sediment mobilization could be enhanced due to the outfall discharge rate increases. Cooling water discharges are the only other LANL effluents introduced into Mortandad Canyon.

Operation of a new RLWTF would have a beneficial impact on surface water quality, as the improved low-level radioactive waste and transuranic waste processes would reduce the contaminant concentrations in the effluent discharged into Mortandad Canyon, and could meet potentially more stringent future water quality standards. Improved surface water quality in RLWTF discharges would reduce the introduction of low levels of radioactive and chemical constituents in an already contaminated canyon reach. One option for the new RLWTF is to eliminate discharges into Mortandad Canyon. If the facility becomes a zero discharge facility, then surface water quality would be positively affected. Elimination of effluent flows into the canyon at the RLWTF outfall would minimize the potential for contaminated sediments to become mobilized in streams, resulting in a beneficial impact to downstream surface water quality. There would be a minor reduction in surface water quantity in Mortandad Canyon if the RLWTF outfall is eliminated. Floodplain size would not be affected by this project.

Pajarito Site

Under the Expanded Operations Alternative, unneeded structures at TA-18 would be removed, thereby removing potential contamination sources from an area where they could possibly be flooded. Parts of TA-18 lie within the 100-year floodplain for Pajarito Canyon. For example, the building that houses the Solution High-Energy Burst Assembly (SHEBA) is partially within the floodplain boundary. Although the possibility of floodwater mobilizing contaminants from the buildings is remote, complete removal of potential contaminant sources would protect surface water quality.

5.3.2 Groundwater Resources

This section addresses potential impacts to groundwater quality in terms of releases that could enter the groundwater over time and potentially contaminate it. The impacts from liquid effluent releases to the canyons and from solid radioactive waste disposal on the mesa tops are evaluated. Use of groundwater to support LANL operations is addressed in Section 5.8.2, Utility Infrastructure.

Impacts to the regional aquifer in the LANL area are generally measured over many years, primarily due to the long time necessary for contaminants to flow through the rock into the regional groundwater and the relatively small volume of water transported through the vadose zone in this arid climate.

For the *1999 SWEIS*, significant adverse impacts to the regional aquifer were defined as changes to groundwater that alter the contaminant levels in concentrations above the drinking water standards in a way that can affect human health and safety. This could occur if any of the activities under consideration in the three alternatives increase the flow rate of contaminants entering the deep groundwater.

Impacts to the alluvial groundwater are likely to occur more rapidly and could be either beneficially or adversely affected by changes to outfall flows from LANL. Some of the surface water carrying contaminants enters the alluvial groundwater system through canyon bottoms. Although surface to subsurface infiltration is fairly rapid in the canyons, any contaminants carried by the surface water are diluted by the large volume of water already in storage in the ground; conversely, uncontaminated surface water infiltrating into already contaminated groundwater would facilitate its dilution over time.

Impacts to the alluvial aquifer may be considered significant if the concentrations of contaminants are altered in relation to the New Mexico and U.S. Environmental Protection Agency (EPA) groundwater standards for irrigation and other nondrinking water uses. An adverse impact to the alluvial aquifer would be significant if, as a result of any of the activities proposed in the alternatives, contaminant levels increase so that the perched groundwater no longer meets state and Federal standards. A significant beneficial impact could occur if contaminant levels were reduced below these standards.

There are still uncertainties about how water borne contaminants interact with and move through rock fractures and the rock matrix into the regional aquifer below LANL. There are uncertainties about the chemistry, volumes, and infiltration rates of liquid wastes from past releases into the canyon bottoms and onto disturbed ground at the MDAs. As discussed in Section 4.3.2, chromium contamination was recently discovered in groundwater wells in Mortandad Canyon. LANL is developing an Interim Measures Work Plan that will include assessments of historical pumping, groundwater gradients, and effluents discharges. Analyses, and field and experimental data will continue to be refined to support the development of corrective measures studies required by the Consent Order and the maintenance of MDA performance assessments and composite analyses, with an emphasis on reducing important uncertainties in the analyses. Flow and transport of contaminants to the regional aquifer are discussed in more detail in the surface

water and groundwater sections in Chapter 4 and in the hydrogeologic and numerical modeling sections in Appendix E.

Recent drilling and new characterization efforts in the vicinity of LANL has resulted in modification of conceptual models that were developed in the past. In 2005, a series of reports of investigations in the Vadose Zone Journal developed conceptual models and discussed flow and transport through the vadose zone to perched ground water bodies and the regional aquifer below LANL. Many of the reports from this series are discussed in Appendix E. The reports describe the need for additional investigations (Newman and Robinson, 2005), the geologic framework of the groundwater system at LANL (Broxton and Vaniman 2004), and components of the conceptual models (Birdsell et al. 2005, Levitt et al. 2005, McLin et al. 2005, and Kwicklis et al. 2005). A LANL report by Rogers and Gallaher (2005) is also used for developing conceptual models. Numerical simulations were run, integrating the older data with new data to verify and modify previous conceptual models (Robinson et al. 2005a, 2005b, and 2005c, and Keating et al. 2005). These preliminary studies are helping to develop insight into the hydrologic properties of the regional aquifer.

LANL will be conducting future data collection activities, along with analysis of existing data. This will help to better define the interaction between groundwater and the rock matrix. It is anticipated that the new data, coupled with improvement in numerical flow and transport models and improved calculational techniques, will enable better prediction of flow and transport of groundwater in the LANL region and more accurately define the ultimate impacts on the regional groundwater resources below LANL. This new information is being used to update the performance assessment and composite analysis for MDA G.

Table 5–6 summarizes the expected groundwater impacts for each of the three alternatives.

Table 5–6 Summary of Environmental Consequences on Groundwater

	No Action Alternative	***Reduced Operations Alternative***	***Expanded Operations Alternative***
		LANL Site	
	Construction and DD&D activities are unlikely to affect the groundwater resource due to their short duration and the small quantity of contaminants that could be released and ultimately infiltrate to groundwater. Operations-related activities including the planned reduction of LANL outfalls would slightly reduce the transport of contaminants into the groundwater. No significant impacts to groundwater are expected to result in the short-term. Long-term impacts to groundwater are not likely to be significant in nature.	Similar to the No Action Alternative in terms of construction and DD&D activities. Long-term impacts as a result of operations might be reduced by elimination of additional outfalls in the canyons.	Similar to the No Action Alternative plus: MDA Remediation: − The effects of capping or removal of waste from the MDAs would not appreciably change the rate of transport of contaminants presently in the vadose zone in the short-term, but would likely reduce long-term contaminant migration and impacts on the environment.

DD&D = decontamination, decommissioning, and demolition, MDA = material disposal area.

5.3.2.1 No Action Alternative

Los Alamos National Laboratory Site-Wide Impacts

There would be no changes in the flow of contaminants to the alluvial or regional groundwater as a result of the No Action Alternative. Proposed construction and demolition activities are unlikely to affect the groundwater resource due to their short duration and the small quantity of contaminants that could be released and ultimately infiltrate to underground water resources, compared to the large volume of water already in storage in the alluvial aquifer, which would dilute any potential contamination to below significant levels.

Groundwater is unlikely to be adversely affected in the short term by the No Action Alternative because discharges of liquid effluent have been curtailed substantially compared to past operations and solid radioactive waste disposal on the mesa tops takes many years to produce any effect in the regional aquifer. As discussed in Section 5.3.1, discharges as a result of LANL operations are monitored to ensure that effluents to surface waters are kept below regulatory limits.

Long-term impacts to groundwater are complex and require modeling to predict potential contaminant migration thousands of years in the future. At the waste disposal locations on the mesa tops, dry conditions coupled with porous flow and transport result in slow unsaturated flow and contaminant transport. Annual net infiltration rates for dry mesas are considered to be less than 0.4 inches per year (10 millimeters per year) and are more often estimated to be on the order of 0.04 inches per year (1 millimeter per year) or less. Under these conditions travel times for contaminants percolating downward beneath the plateau to the regional aquifer are expected to be several hundred to thousands of years. However, site disturbance can alter how quickly water moves through the vadose zone (Birdsell et al. 2005).

Groundwater modeling was performed for a performance assessment and composite analysis prepared for radioactive waste disposal at MDA G (LANL 1997a). The analysis assessed impacts assuming the continued existence of the interim covers currently covering the waste disposal units. The groundwater protection analysis analyzed performance over a period of 10,000 years to provide reasonable assurance that the groundwater protection performance objective could be met. There were no offsite doses from the groundwater pathway during the institutional control period, because no radionuclides were transported beyond the current LANL boundary within 100 years. Projected groundwater ingestion doses were small, with only three contributing radionuclides, carbon-14, technetium-99, and iodine-129. The peak annual dose at 330 feet (100 meters) downgradient from MDA G was 1.4×10^{-5} millirem at 4,000 years. The peak annual dose at the Pajarito Canyon location was 4.5×10^{-5} millirem at 700 years. This is well below the 4 millirem per year standard for groundwater protection (LANL 1997a).

Under the No Action Alternative, MDA H would be closed. The DOE preferred closure option is to close MDA H in place and cover with an engineered barrier. The engineered cover would be designed, constructed and maintained in order to limit infiltration and to slow contaminant migration from the MDA. The environmental assessment (EA) for the proposed corrective measures at MDA H concluded that neither surface nor groundwater quality would be adversely affected from implementing this closure option over the next 1,000 years (DOE 2004e).

5.3.2.2 Reduced Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Most impacts identified as occurring under the No Action Alternative to groundwater resources would also occur under the Reduced Operations Alternative. Long-term impacts might be reduced by elimination of some outfalls in the canyons, but no quantitative estimate of the reduction or its rate can be predicted at this time.

5.3.2.3 Expanded Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Impacts identified as occurring under the No Action Alternative to groundwater resources would also occur under the Expanded Operations Alternative. Direct and indirect impacts to groundwater as a result of proposed construction and operations under the Expanded Operations Alternative would also be similar to those described for the No Action Alternative.

Possible impacts to groundwater resources will be addressed as part of any required corrective measure evaluation to be performed for MDAs and other PRSs in accordance with the Consent Order. A corrective measure evaluation for an MDA would consider alternatives including capping and removal, two bounding options for MDA remediation that were considered in Appendix I. LANL management would recommend remedies for each MDA (or other PRS subject to the Consent Order), and a decision on the remedy to be applied would be made by NMED. A corrective measure evaluation performed for MDA G in TA-54 would be coordinated with the update to the performance assessment and composite analysis that is currently under preparation. This update would consider the application of a final cover over the disposal units, and would also update information about the site and the contents of the disposal units.

The effects of either a capping or removal option would not appreciably affect the rate of transport of contaminants presently in the vadose zone in the near term, but would likely reduce very long-term migration of contaminants and corresponding impacts on the environment, from wastes present in the MDAs. Where engineered barriers are used to cap MDAs, under the MDA Capping Option, they would be designed, constructed and maintained in order to limit infiltration. Over the long-term, the covers, by limiting infiltration, would slow contaminant migration from the MDAs. Excavation and removal of the waste and contaminated soil and rock, under the MDA Removal Option, would eliminate nearly all of the source term. However, the filled, compacted excavation may still experience larger infiltration rates (for a time) than undisturbed areas, which might further drive migration of deeper contaminants that are beyond the reach of conventional excavation. Under either MDA remediation option, impacts to the regional aquifer would likely be small as described under the No Action Alternative.

5.4 Air Quality and Noise

5.4.1 Nonradiological Impacts

Air pollution refers to the introduction, directly or indirectly, of any substance into the air that could:

- endanger human health,
- harm living resources and ecosystems,
- damage material property, or
- impair or interfere with the comfortable enjoyment of life and other legitimate uses of the environment.

For the purpose of this SWEIS, only outdoor air pollutants were addressed. They may be in the form of solid particles, liquid droplets, gases, or a combination of these forms. Generally, they can be categorized as primary pollutants (those emitted directly from identifiable sources) and secondary pollutants (those produced in the air by interaction between two or more primary pollutants or by reaction with normal atmospheric constituents that may be influenced by sunlight). Air pollutants are transported, dispersed, or concentrated by meteorological and topographical conditions. Thus, air quality is affected by air pollutant emission characteristics, meteorology, and topography.

Ambient air quality in a given location can be described by comparing the concentrations of various pollutants in the atmosphere with the appropriate standards. Ambient air quality standards have been established by Federal and state agencies, allowing an adequate margin of safety for the protection of public health and welfare from the adverse effects of pollutants in the ambient air. Pollutant concentrations higher than the corresponding standards are considered unhealthy; those below such standards are considered acceptable.

The pollutants of concern are primarily those for which Federal and state ambient air quality standards have been established, including criteria air pollutants, hazardous air pollutants, and other toxic air pollutants. Criteria air pollutants are those listed in Title 40 of the *Code of Federal Regulations,* Part 50 (40 CFR 50), "National Primary and Secondary Ambient Air Quality Standards." Hazardous air pollutants and other toxic air pollutants are those listed in Title I of the Clean Air Act, as amended (Title 40 of the *United States Code*, Section 7401 *et seq.* [40 U.S.C. 7401 *et seq.*]), those regulated by the National Emissions Standards for Hazardous Air Pollutants (40 CFR 61), and those that have been proposed or adopted for regulation by the applicable state or are listed in state guidelines or permit regulations. States may set ambient standards that are more stringent than the National Ambient Air Quality Standards. The more stringent of the state or Federal standards are shown in this document.

Potential air quality impacts of criteria pollutant emissions from construction, normal operations, and DD&D activities were evaluated for each alternative. This assessment includes a comparison of pollutant concentrations under each alternative with applicable Federal and state ambient air quality standards. Operational air pollutant impacts were evaluated for combustion sources using the facility-wide analysis prepared for the LANL operating permit as described in Appendix B. The analysis is based on the potential emissions from each source. The results of

this analysis bound the potential impacts associated with the alternatives addressed in this SWEIS. Potential differences from these results are discussed for each alternative. The analysis included the following emission sources: air curtain destructors, TA-60 asphalt plant, four TA-16 boilers, three TA-48 boilers, two TA-53 boilers, two TA-55 boilers, two TA-59 boilers, a TA-50 boiler, carpenter shops at TA-15 and TA-3, TA-33 generator, TA-52 paper shredder, TA-3 power plant, rock crusher, TA-21 steam plant, TA-9 boiler, and TA-35 boiler. The analysis was based on allowable facility-wide emission limits proposed in the permit application. Emissions were presented in the application for individual sources or for source groups. The emissions used in the analysis are conservative. For example, for the TA-3 boilers the fuel with the highest emissions was assumed and all three boilers were assumed to operate simultaneously, when normally only two boilers are operated at the same time (Jacobson, Johnson, and Rishel 2003). Also, air curtain destructors have been removed from operation at LANL. The impact of criteria pollutant emissions from construction activities for various projects was evaluated using engineering estimates of emissions from site preparation and building erection activities and modeled using the Industrial Source Complex Short Term (ISCST3) dispersion model as discussed in Appendix B.

Unlike a production facility with well-defined operational processes and schedules, LANL is a research and development facility with great fluctuations in both the types of chemicals emitted and their emission rates. Because LANL's toxic air pollutant emission rates are relatively low (compared to releases from production facilities), vary greatly, are released from hundreds of sources spread out over a large geographic area, and are well below the state's permitting threshold limits, toxic air pollutant emissions are not monitored.

The approach used to evaluate chemical air pollutants in the *1999 SWEIS* is based on the use of screening level emission values to identify chemicals that would be evaluated in more detail. Screening level emission values are conservatively estimated hypothetical emission rates for each of the toxic air pollutants that could potentially be emitted from each of LANL's technical areas and that would not result in air quality levels harmful to human health under current or future conditions. These screening level emission values were compared with conservatively estimated pollutant emission rates on a TA-by-TA basis to determine potential air quality impacts of toxic air pollutants from LANL operations. Any pollutant with the potential to contravene a guideline value was subject to evaluation in the health and ecological risk assessment process. This approach is described in more detail in Appendix B.

Table 5–7 summarizes the expected nonradiological air quality impacts for each of the three alternatives.

5.4.1.1 No Action Alternative

This section describes the estimated non-radiological air quality impacts from LANL operations under the No Action Alternative. The discussion includes estimated impacts from nonradiological air emissions. Radiological air emissions and their impacts on human health are discussed in Sections 5.4.2 and 5.6.1, respectively.

Table 5–7 Summary of Environmental Consequences on Nonradiological Air Quality

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site			
	General: – Minor impacts from construction-type activities would occur primarily in the form of fugitive dust. Land Conveyance and Transfer: – Minor increases in air pollutant emissions could result from increases in commute distances. Power Grid Infrastructure Upgrade and Security Perimeter Project: – Minor air quality impacts would result from construction. Wildfire Hazard Reduction Program: – Minor emissions would result from activities. Disposition of Flood and Sediment Retention Structures: – Minor emission would result from activities. Trails Management Project: – Minor air quality impacts.	Same as No Action Alternative	Same as No Action Alternative Plus: – Minor air quality impacts would result from road, bridge, and walkway construction under the Security-Driven Transportation Modifications Project. – Minor increases in vehicle emissions could result from use of the new roads and these would occur in new locations. – Minor to moderate air quality impacts would result from remediating MDAs and other PRSs.
Affected Technical Areas			
TA-3	– Minor change in air quality impacts from operation of new turbine generators. – Minor air quality impacts from constructing 3 new office buildings. – Minor operation air quality impacts from new office buildings.	Same as No Action Alternative	Same as No Action Alternative, plus: – Minor construction air quality impacts from constructing additional office buildings and Center for Weapons Programs Research.
TA-21	No change in air quality impacts	Same as No Action Alternative	– Minor construction-type air quality impacts from DD&D of structures.
TA-54	– Minor air quality impacts would result from MDA closure activities. Some reductions in emissions could result from closure.	Same as No Action Alternative	– Minor construction-type air quality impacts from construction of new buildings and DD&D of old structures.
TA-72	No change in air quality impacts	Same as No Action Alternative	– Minor construction-type air quality impacts from constructing Remote Warehouse and Truck Inspection Station. – Potential decrease in emissions from reduced delivery trips

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Key Facilities			
Chemistry and Metallurgy Research (TA-3, TA-48, and TA-55)	– Minor air quality impacts from construction of new facility at TA-55.	Same as No Action Alternative	Same as No Action Alternative
High Explosives Processing Facility	Minor construction-type impacts from TA-16 Engineering Complex and demolition of structures. No change in operations air quality impacts.	Same as No Action Alternative for construction. Minor reduction in operations air quality impacts from 20 percent reduction in activities.	Same as No Action Alternative for construction. Minor increase in operations air quality impacts.
High Explosives Testing Facility	No change in operation air quality impacts. Minor construction impacts from construction of 15 to 25 new structures (new offices, laboratories, and shops) within the TA-22 to replace about 59 structures currently used for dynamic experimentation operations and removal or demolition of vacated structures.	Reduction in operation air quality impacts from 20 percent reduction in activities. Same as No Action Alternative for construction.	Same as No Action Alternative
Tritium Facility (TA-21)	No change in air quality impacts	Same as No Action Alternative	– Minor construction-type air quality impacts from DD&D of all TA-21 tritium buildings as part of the project to decommission all of TA-21. – Minor reduction in operational emissions from shutdown of boilers under the complete DD&D option.
Pajarito Site (TA-18)	No change in air quality impacts	Minor reduction in operation air quality impacts from shut down of activities.	– Minor reduction in operation air quality impacts from shut down of activities. – Minor construction-type air quality impacts from DD&D of TA-18 buildings.
Bioscience Facilities	No change in air quality impacts	Same as No Action Alternative	– Minor change in operation impacts with transfer of the Bioscience Facilities operations to the new Science Complex location. – Minor construction air quality impacts from construction of the new Science Complex and associated DD&D actions.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Radiochemistry Facility (TA-48)	No change in air quality impacts	Same as No Action Alternative	Same as No Action Alternative for operation. – Minor construction air quality impacts from construction of the new Radiological Sciences Institute with construction of the Institute for Nuclear Nonproliferation Science and Technology (see Appendix G) and associated DD&D actions.
Radioactive Liquid Waste Treatment Facility (TA-50)	No change in air quality impacts	Same as No Action Alternative	Same as No Action Alternative for operation. – Minor construction air quality impacts from construction of a replacement for the existing Radioactive Liquid Waste Treatment Facility at TA-50 (see Appendix G) and DD&D of the existing Radioactive Liquid Waste Treatment Facility.
LANSCE (TA-53)	No change in air quality impacts	Reduction in air quality impacts from shut down of LANSCE operations.	Negligible to minor air quality impacts from refurbishment.
Solid Radioactive and Chemical Waste Facilities (TA-50 and TA-54)	No change in air quality impacts	Same as No Action Alternative	Minor air quality impacts from retrieving transuranic waste from below ground storage. – Minor air quality impacts from construction of a new Transuranic Waste Processing Facility and new access control station, low-level radioactive waste compactor building, and low-level radioactive waste certification building and associated DD&D actions.
Plutonium Facility Complex (TA-55)	No change in air quality impacts	Same as No Action Alternative	Same as No Action Alternative for operation. – Minor air quality impact from facility modifications in support of increased pit production rate and TA-55 Reinvestment Project, and constructing radiography capabilities (see Appendix G).

MDA = material disposal area, PRS = potential release site, TA = technical area, DD&D = decontamination, decommissioning, and demolition, LANSCE = Los Alamos Neutron Science Center,

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Minor impacts on non-radiological air quality would occur from construction-type activities related to previously approved projects including construction of the power grid infrastructure upgrade, Wildfire Hazard Reduction Program activities, disposition of flood and sediment retention structures, activities related to the Trail Management Project, mechanical and manual Wildfire Hazard Reduction Program activities, and construction related to the Security Perimeter Project. These projects would result in temporary elevated concentrations of criteria air pollutants, especially fugitive dust from heavy equipment activity.

Analysis of criteria pollutant emissions from facilities at LANL was performed to obtain the LANL Title V operating permit. The results of this analysis were used to bound the potential impacts associated with the alternatives addressed in this SWEIS. The results of the modeling demonstrate that the simultaneous operation of LANL's air emission sources at maximum capacity, as described in the Title V permit application, would not exceed any state or Federal ambient air quality standards (Jacobson, Johnson, and Rishel 2003). These results are presented in **Table 5–8**. All of the equipment at the TA-3 Co-Generation Complex, including the three existing boilers, the new combustion turbine generator and an additional combustion turbine generator that would be constructed in the 2007 to 2013 timeframe would operate within the nitrogen oxides and carbon monoxide emission limits specified in the air quality permit, 100 tons (91 metric tons) per year and 81 tons (74 metric tons) per year, respectively (NMED 2004c, Jacobsen, Johnson, and Rishel 2003, DOE 2002l). These emission limits were used in this site-wide analysis.

Table 5–8 Facility-wide Criteria Pollutant Impacts

Pollutant	*Time Period*	*Maximum Estimated Concentrations (micrograms per cubic meter)*	*New Mexico Controlling Ambient Air Quality Standards [a] (micrograms per cubic meter)*
Carbon monoxide	8 hours 1 hour	192.4 1,071	7,900 11,900
Nitrogen dioxide	Annual 24 hours	7.0 40.2	75 150
Sulfur dioxide	Annual 24-hours 3-hours	10.2 83.5 397.3	42 209 1,050
Total suspended particulates	Annual 24-hours	5.7 135.0	60 150
PM_{10}	Annual 24-hours	5.24 101.6	50 150

PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 microns.

[a] New Mexico Ambient Air Quality standards for pollutants other than particulate matter are stated in parts per million. These values were converted to micrograms per cubic meter, with appropriate corrections for temperature and pressure (elevation) following New Mexico Dispersion Modeling Guidelines (NMAQB 2003).

Source: Jacobson, Johnson, and Rishel 2003.

For criteria pollutants, the concentrations from No Action Alternative operations would be less than shown in the operating permit and well below the ambient standards established to protect human health with an adequate margin of safety. Criteria pollutant emissions under the No Action Alternative are expected to continue to have minor impacts on human health.

Similarly, for toxic air pollutants, the bounding analyses (based on the emission rates evaluated in the *1999 SWEIS*) indicate that the pollutant emissions with the potential to exceed the guideline values used in the analysis to screen emission rates were:

- Emissions from High Explosives Firing Site operations at TA-14, TA-15, TA-36, TA-39, and TA-40 (DOE 1999a); the estimated concentration of a pollutant would be greater than its guideline value for the following releases:
  - Depleted uranium, beryllium, lead, aluminum, copper, tantalum, tungsten, and iron from TA-15;
  - Depleted uranium, beryllium, lead, copper, and iron from TA-36;
  - Beryllium, lead, aluminum, and copper from TA-39;
  - Depleted uranium and lead from TA-14; and
  - Copper from TA-40.
- The additive emissions from all of the pollutants from all technical areas on receptor sites located near the Los Alamos Medical Center (DOE 1999a).

In the *1999 SWEIS*, emissions from high explosives testing site operations under the No Action Alternative were projected to be the same as the emissions projected under the Expanded Operations Alternative and this projection is similar to anticipated emissions from high explosives testing site operations under the No Action Alternative in this SWEIS. The emissions from high explosives testing site operations are shown in **Table 5–9**.

These emissions are estimated to result in toxic air pollutant concentrations that are above guidance values, indicating that a human health analysis should be performed. This human health analysis (Section 5.6.2) indicated that the nonradiological pollutants released from LANL high explosives testing site operations under the No Action Alternative are not expected to cause air quality impacts that would affect human health. Although not considered in the analysis, recent use of foam to suppress emissions from some high explosives tests has reduced emission from these shots by 50 to more than 80 percent. Increased use of foam and vessels for explosives testing is expected to further reduce these emissions (LANL 2006)

A minor increase in vehicle emissions could result from development that occurs under Land Conveyance and Transfer. This increase is not expected to result in concentrations of pollutants that would threaten human health.

Emissions from beryllium sources at TA-3 and TA-55 are controlled by high-efficiency particulate air (HEPA) filtration with a removal efficiency of 99.95 percent. These emissions were analyzed in the 1999 SWEIS using the annual emission rates estimated based on the existing permit applications as shown in **Table 5–10**. The results of the analysis with regard to public health are discussed in Section 5.6.2.

Table 5–9 Estimated Emission Rates of the Pollutants that Have the Potential to be Released from High Explosives Testing Sites

TAs with High Explosives Testing Operations [a]	*Pollutants that Have the Potential to be Released During Testing Operations*	*Estimated Maximum Amount of Material that Will Be Used During Testing Operations* [b]	*Estimated Respirable Fraction Release Rate*		
			Annual Rate [b]	*8-Hour Respirable Release Rate* [c]	
		(kilograms per year)	*(kilograms per year)*	*(kilograms)*	*(grams)* [d]
TA-14	Depleted Uranium	31.4	3.1	0.267	267
	Lead	31.4	3.1	0.267	267
TA-15	Depleted Uranium	2,700	270.0	23.0	23,000
	Beryllium	30	3.0	0.256	256
	Lead	150	15.0	1.28	1,280
	Aluminum	450	45.0	3.83	3,830
	Copper	300	30.0	2.56	2,560
	Tantalum	300	30.0	2.56	2,560
	Tungsten	300	30.0	2.56	2,560
	Iron	150	15.0	1.28	1,280
TA-36	Depleted Uranium	1,200	120.0	10.2	10,200
	Beryllium	30	3.0	0.256	256
	Lead	30	3.0	0.256	256
	Aluminum	30	3.0	0.256	256
	Copper	30	3.0	0.256	256
	Tantalum	30	3.0	0.256	256
	Tungsten	30	3.0	0.256	256
	Iron	150	15.0	1.28	1,280
TA-39	Beryllium	30	3.0	0.256	256
	Lead	30	3.0	0.256	256
	Aluminum [e]	45,000	4,500.0	383	383,000
	Copper [e]	45,000	4,500.0	383	383.000
	Tantalum	30	3.0	0.256	256
	Tungsten	30	3.0	0.256	256
	Iron [e]	30,000	3,000.0	256	256,000

TAs with High Explosives Testing Operations [a]	*Pollutants that Have the Potential to be Released During Testing Operations*	*Estimated Maximum Amount of Material that Will Be Used During Testing Operations* [b]	*Estimated Respirable Fraction Release Rate*		
			Annual Rate [b]	*8-Hour Respirable Release Rate* [c]	
		(kilograms per year)	*(kilograms per year)*	*(kilograms)*	*(grams)* [d]
TA-40	Aluminum	240	24.0	2.04	2,040
	Copper	300	30.0	2.56	2,560
	Tantalum	90	9.0	0.767	767
	Tungsten	30	3.0	0.256	256
	Iron	60	6.0	0.511	511

TA = technical area.

[a] High explosives testing operations involve detonations of explosives at TA-14, TA-15, TA-36, TA-39, and TA-40. Particulate emissions released into the atmosphere due to detonation of high explosives contain bonded metal emissions in respirable form.

[b] Respirable release rates were estimated based on the assumption that this fraction is 10 percent of the amount of material exploded.

[c] The total 8-hour respirable release rates (in kilograms), as a result of these operations, were estimated using the scale factor of 0.085.

[d] The total amount of material released, in grams, was used in dispersion analysis to estimate 1-hour average concentrations at specified receptor locations.

[e] These quantities are dominated by the support structures constructed for tests. These structures in actuality are not expended in explosive tests and do not contribute to test air emissions.

Note: To convert kilograms to pounds, multiply by 2.2046; grams to ounces, multiply by 0.035274.

Source: DOE 1999a.

Table 5–10 Beryllium Annual Emission Rates Associated with Technical Area 3 and Technical Area 55 Facilities

Emission Source	*Annual Permitted Emission Rate*	
	Pounds per Year	*Grams per Second*
TA-3 Building 141	0.11	1.58×10^{-6}
TA-55 FE-15	0.003	4.32×10^{-8}
TA-55 FE-16	0.0042	6.05×10^{-8}

TA = technical area.
Source: DOE 1999a.

Technical Area Impacts

Minor construction-related non-radiological air quality impacts would occur from the construction of new office buildings at TA-3 and MDA H closure activities at TA-54. The new turbine generator at TA-3 would operate within the emission combustion limits specified in the air quality permit for the TA-3 Co-Generation Complex (DOE 2002l) and analyzed in the facility-wide air quality impact analysis; minor operations related air quality impacts would be expected.

Key Facilities Impacts

Minor non-radiological air quality impacts would occur from the construction of the Chemistry and Metallurgy Research Building Replacement at TA-55, completion of TA-16 Engineering Complex, demolition of structures at TA-16, construction of new buildings at the consolidated Twomile Mesa Complex within TA-22, and demolition of unneeded structures nearby as described below.

Operation of new buildings including the Chemistry and Metallurgy Research Building Replacement, TA-16 Engineering Complex, various new structures for dynamic experiment operations, and a new dynamic experimentation structure at TA-15 would not be expected to result in an increase in emissions of criteria pollutants because a comparable amount of space would be removed through DD&D resulting in a comparable reduction in emissions. Emissions related to these facilities are primarily associated with heating of facilities and providing electric power.

Chemistry and Metallurgy Research Building

Operation of the Chemistry and Metallurgy Research Building Replacement at TA-55 would result in additional periodic testing of emergency generators at that location instead of at TA-3. This change in operations would likely result in minor impacts on air pollutant concentrations at the site boundary. Criteria pollutant concentrations at the site boundary estimated for generator testing are shown in **Table 5–11**.

Table 5–11 Air Quality Concentrations from Chemistry and Metallurgy Research Building Generator Testing at Technical Area 55 [a]

Pollutant	*Averaging Period*	*Maximum Incremental Concentration (micrograms per cubic meter)*
Carbon monoxide	8 hours 1 hour	53.2 23.9
Nitrogen dioxide	Annual 24 hours	0.0182 45.1
Sulfur dioxide	Annual 24 hours 3 hours	0.0113 28.1 207
Total suspended particulates	Annual 24 hours	0.001 2.43
PM_{10}	Annual 24 hours	0.001 1.39

PM_{10} = particulate matter less than or equal to 10 microns in diameter.
[a] The annual concentrations were analyzed at locations to which the public has access – the site boundary and nearby sensitive areas. Short-term concentrations were analyzed at the site boundary and at the fence line of the technical area to which the public has short-term access. Since access to the TA-55 fenceline has been restricted since the EIS for this facility was prepared, the short-term concentrations in public areas would be less.
Source: DOE 2003f.

Plutonium Facility Complex

Operations at TA-55 to produce 20 pits per year would represent about 25 percent of the 80 pits per year production analyzed in the *1999 SWEIS* for the Expanded Operations Alternative. Emission estimates for the Plutonium Facility Complex for 2004 included about 0.85 tons (0.77 metric tons) per year of hazardous air pollutants, which is well below the 14.6 tons (13.2 metric tons) per year evaluated in the *1999 SWEIS* (DOE 1999a, LANL 2005g). Most of the estimated emissions are hydrochloric and nitric acids from plutonium recovery operations for the complex and are not directly associated with the level of pit production. However, the impacts of hazardous air pollutant emissions under the No Action Alternative would be less than analyzed.

5.4.1.2 Reduced Operations Alternative

Non-radiological air quality impacts anticipated to occur from the activities associated with the No Action Alternative would still occur under the Reduced Operations Alternative with exception of those actions explicit to the Reduced Operations Alternative.

Los Alamos National Laboratory Site-Wide Impacts

Minor impacts on air quality would occur from construction-related activities on previously approved projects as discussed for the No Action Alternative. No new construction impacts on air quality would result from implementing the Reduced Operations Alternative.

For criteria pollutants, the Reduced Operations Alternative operation overall emission rates would likely be lower than those under the No Action Alternative as a result of cessation of operations at TA-18 and shutdown of LANSCE. The boilers at TA-53 represent emissions of less than 1 percent of the emissions from facilities at LANL. Although it is unlikely that these

boilers would be completely shutdown if LANSCE were shutdown, the use of these boilers would be reduced and would result in a small reduction in pollutant emissions. Criteria pollutant emissions under the Reduced Operations Alternative are expected to result in concentrations below the ambient standards and to have minor impacts on human health.

Similarly, for toxic air pollutants, the number of high explosives experiments each year under the Reduced Operations Alternative would be less than for the No Action Alternative. As discussed in the No Action Alternative (Sections 5.4.1.1 and 5.6.2.1), these emissions would result in concentrations that would not be expected to cause air quality impacts that would affect human health.

Under the Reduced Operations Alternative, chloroform use would be similar to usage projected under the No Action Alternative. As discussed for the No Action Alternative, this use level is expected to result in emissions of chloroform that would not be expected to cause air quality impacts that would affect human health.

Based on the information discussed above, the release of toxic air pollutants released under the Reduced Operations Alternative are not expected to cause air quality impacts that would affect human health and the environment.

Technical Area Impacts

Construction- and operations-related air quality impacts would be the same as under the No Action Alternative, except as described below in relations to Key Facilities.

Key Facilities Impacts

Construction-related non-radiological air quality impacts from Key Facilities would be the same as under the No Action Alternative.

High Explosives Processing and High Explosives Testing

A minor reduction in operational impacts would be expected from the 20 percent reduction in High Explosives Processing and High Explosives Testing activities. This could result in a reduction of about 0.05 tons (0.045 metric tons) per year of hazardous air pollutant emissions from High Explosives Testing and 0.2 tons (0.18 metric tons) per year from high explosives processing.

Los Alamos Neutron Science Center

Implementing the Reduced Operations Alternative for LANSCE at TA-53 would result in the shut down of that facility, and a reduction in emissions from the TA-53 boilers.

Pajarito Site

Shut down of operations at the Pajarito Site (TA-18) would also reduce emissions. This would result in a minor positive affect on overall air quality.

5.4.1.3 Expanded Operations Alternative

Non-radiological air quality impact that would occur from activities associated with the No Action Alternative would still occur under the Expanded Operations Alternative.

Los Alamos National Laboratory Site-Wide Impacts

Under the Expanded Operations Alternative, there would be emissions of criteria and toxic air pollutants, including fugitive dust, from construction activities at LANL. These emissions would be short term for any particular project, but could be ongoing for a longer total period of time as various facilities are constructed, demolished, and closed. In addition to the construction activities described for the No Action Alternative, there would be construction of various new buildings in various technical areas; DD&D of buildings; road, bridge, and walkway construction under the Security-Driven Transportation Modifications; and MDA remediation (as described in Appendix I) that would result in temporary increases in air pollutant concentrations at the site boundary and along roads to which the public has access. These impacts, except from MDA activities, would be similar to the impacts of other recent construction-type activities at LANL. Emissions of fugitive dust from these activities would be controlled with water sprays, application of soil stabilizers, and other controls as appropriate. The maximum ground-level concentrations offsite and along roads to which the public has regular access would be below the ambient air quality standards, except for possible short-term concentrations of nitrogen oxides and carbon monoxide for certain projects that occur near the site boundary. The impact on the public would likely be minor.

The MDA Capping and Removal options would require the use of heavy equipment that would result in additional air pollutant emissions including criteria and hazardous pollutants. At some locations these activities would be of longer duration than typical construction activities at LANL and would involve extensive movement of materials. Estimated emissions from these activities are presented in Appendix I. Particulate matter would be dispersed into the air from grading, earthmoving, and compaction at the MDA sites and at the borrow pit from which capping material or fill is excavated. These emissions have been estimated to be considerable and could result in minor to moderate increases in short term concentrations of criteria pollutants near the MDA activities and TA-61 borrow pit which in some cases occur near the site boundary and nearby residences and businesses. For example, based on the schedule and remediation methods assumed in Appendix I for the Removal Option at TA-21 (MDA-A, -B, -T, and –U), concentrations at the site boundary near the Los Alamos town site were estimated to be above the 1-hour ambient standard for carbon monoxide and the 24-hour standard for nitrogen dioxide. Also, for the Removal Option at TA-54 (MDA G) concentrations at the site boundary near White Rock were estimated to be above the 1-hour and 8-hour ambient standards for carbon monoxide and the 24-hour and annual standards for nitrogen dioxide. The contribution to particulate matter less than or equal to 10 microns in diameter (PM_{10}) concentrations from Removal at MDA G would be more than 80 percent of the ambient standard. Concentrations under the Capping option at MDA G would be about 6 percent of those under the Removal Option. The overall emissions from heavy equipment for the Removal Option were estimated to be more than 20 times those for the Capping Option. The Removal Option would greatly reduce or eliminate long-term release of volatile organic compounds from the MDAs. Particulate emissions would be controlled using standard dust control measures such as water sprays or through use of a

containment structure. Other emissions would be reduced by management controls and scheduling such that impacts on the public are minimized.

Changes in LANL operations proposed under the Expanded Operations Alternative, including relocation of existing operations, reinvestment and refurbishment of existing facilities, and new operations or levels of operations, would not result in emissions beyond the level evaluated for the facility-wide air quality impact analysis (see Section 5.4.1.1). The results of the analysis bound the impacts of the Expanded Operations Alternative, and the highest estimated concentration of each pollutant would be below the ambient air quality standards and would likely have minor impacts on human health.

The impacts of toxic air pollutants for this new SWEIS were assessed based on the analysis on the *1999 SWEIS* Expanded Operation Alternative. In all but two cases, the estimated toxic pollutant concentrations would be below the corresponding guideline values established for the analysis in the *1999 SWEIS*. Guideline values are the levels established to identify chemicals for further analysis. The two cases where estimated emission rates would be above guideline values (these were referred to the human health and ecological risk assessment processes for further analysis) were High Explosive Firing Site operations and the additive emissions from all pollutants from all technical areas on receptor sites located at or near the Los Alamos Medical Center.

Operational nonradioactive air pollutants released under the Expanded Operations Alternative in this SWEIS would not be expected to cause air quality impacts that would affect human health and the environment (see Sections 5.4.1.1 and 5.6.2). In addition, if activities from the Bioscience Facilities were moved to the new Science Complex, the impacts due to LANL operations on receptor sites located near the Los Alamos Medical Center would likely be reduced.

Minor changes in vehicle emissions could result from the Security-Driven Transportation Modifications. A small increase from shuttle bus emissions could be partially offset by a decrease from less use of personally owned vehicles.

Technical Area Impacts

Construction nonradiological air quality impacts would be the same as under the No Action Alternative for specific technical areas (TA-3, TA-21, and TA-54), except there would be additional temporary construction impacts from additional office buildings and the Center for Weapons Programs Research at TA-3, minor construction impacts from DD&D of TA-18 buildings, and temporary construction impacts from the Science Complex and the Remote Warehouse and Truck Inspection Station. Construction impacts would occur during daytime hours from construction equipment operations and fugitive dust generation.

Operational nonradiological air quality impacts from specific technical areas (TA-3, TA-21, and TA-54) would be similar to those under the No Action Alternative. There would be a potential decrease in emissions from reduced intra-facility vehicle trips related to the Science Complex and a potential decrease in emissions from reduced delivery trips as a result of the new Remote Warehouse and Truck Inspection Station.

Key Facilities Impacts

Construction nonradiological air quality impacts from Key Facilities would be similar to those of the No Action Alternative.

Minor temporary construction impacts would occur from DD&D of TA-21 buildings, DD&D of TA-18 buildings, construction of the new Science Complex, construction of the new Radiological Sciences Institute with construction of the Institute for Nuclear Nonproliferation Science and Technology, construction of a replacement for RLWTF at TA-50, DD&D of the existing RLWTF, retrieval of transuranic waste from below ground storage at Solid Radioactive and Chemical Waste Facilities, construction of a new Transuranic Waste Processing Facility and other buildings, and minor facility modifications at TA-55.

Operation of new buildings including those discussed under the No Action Alternative, the new Science Complex, the Radiological Sciences Institute, the Institute for Nuclear Nonproliferation Science and Technology, the replacement RLWTF, the new Transuranic Waste Processing Facility, and new office buildings at TA-55 would not be expected to result in an increase in emissions of criteria pollutants because a comparable amount of space would be removed through DD&D. These emissions are primarily associated with heating of facilities and providing electric power. Operational nonradiological air quality impacts from other Key Facilities would be the same as under the No Action Alternative.

High Explosives Processing

There would be a minor increases in operation impacts from the 2.5 percent increase in High Explosives Processing activity. This could result in an increase of about 0.03 tons (0.027 metric tons) per year of hazardous air pollutant emissions from High Explosives Processing.

Tritium Facility

Operations related emissions from three boilers at TA-21 would be eliminated resulting in a reduction of as much as 1.6 tons (1.5 metric tons) per year of nitrogen oxides (about 3.2 percent of nitrogen oxides emissions at LANL), 0.12 tons (0.11 metric tons) of particulates, (about 2.5 percent of LANL total), and 1.3 tons (1.2 metric tons) of carbon monoxide emissions (about 3.7 percent of carbon monoxide emissions at LANL).

5.4.2 Radiological Air Quality Impacts

Impacts of the emission of radioactive constituents to the air from the continued operation of LANL are evaluated in terms of the increased dose (above the dose from background radiation) and corresponding risk of a latent cancer fatality (LCF) to the population in the vicinity of LANL and to a nearby maximally exposed individual (MEI). That impacts assessment is presented in Section 5.6. The following assessment of radiological air quality impacts is an intermediate step in developing the estimates of dose. The impacts are presented here as the projected quantities of radionuclides emitted under each alternative.

Radioactive air emissions from LANL come from both point sources, such as stacks and vents, and diffuse or nonpoint sources. Although there are other minor contributors of radioactive

emissions, the Key Facilities represent essentially all of the site emissions that are relevant to the calculation of doses to the population and an MEI. Specifically, a few facilities and certain radionuclides dominate the human health effects and are therefore those on which this analysis is focused. These include gaseous mixed activation products associated with LANSCE operations and tritium, plutonium, americium, and uranium associated with a number of the other Key Facilities.

Table 5–12 summarizes the expected radiological air emissions for each of the three alternatives. Air emissions are summarized as total emissions for the site. A detailed presentation of the radionuclides emitted from each of the Key Facilities is included in Appendix C.

Table 5–12 Summary of Annual Projected Radiological Air Emissions (curies per year)

	No Action Alternative	***Reduced Operations Alternative***	***Expanded Operations Alternative***
LANL Site [a]			
Tritium [b]	2,400	2,400	2,400 [c]
Americium-241	4.2×10^{-6}	4.2×10^{-6}	4.2×10^{-6} [d]
Plutonium [e]	0.00082	0.00082	0.00084 [d]
Uranium [f]	0.15	0.12	0.15
Particulate and Vapor Activation Products	30	0.014	30
Gaseous Mixed Activation Products	30,500	100 [g]	30,500 [g]
Mixed Fission Products [h]	1,650	1,650	1,650
Affected Technical Areas			
TA-21, TA-49, TA-50, TA-54 for major MDAs	Not applicable	Not applicable	Variable [i]

TA = technical area, MDA = material disposal area.

[a] These LANL site data include emissions from all Key Facilities. Radiological air emission data by Key Facility are presented in Appendix C.

[b] Includes both gaseous and oxide forms of tritium.

[c] Tritium emissions would decrease to 1,850 curies per year starting in 2009 following decontamination, decommissioning, and demolition of TA-21.

[d] Americium-241 emissions could increase to 1.1×10^{-5} curies per year and plutonium emissions to 0.00089 curies per year if the Decontamination and Volume Reduction System, the new Transuranic Waste Consolidation Facility, and remote-handled transuranic waste retrieval and processing activities operated simultaneously (estimated to occur from 2012 through 2015).

[e] Includes plutonium-238, plutonium-239, and plutonium-240.

[f] Includes uranium-234, uranium-235, and uranium-238.

[g] Gaseous mixed activation product emissions would decrease by 100 curies per year starting in 2009 due to the shutdown of TA-18, resulting in zero gaseous mixed activation product emissions for the Reduced Operations Alternative and 30,400 curies per year in the Expanded Operations Alternative.

[h] Mixed fission products include krypton-85, xenon-131m, xenon-133, and strontium-90.

[i] There would be additional emissions from the remediation of the larger MDAs. These emissions would depend on radionuclides present, whether an MDA is being capped or removed, the number of MDAs being remediated at one time, and whether exhumation occurs under a containment structure (see Appendix I).

5.4.2.1 No Action Alternative

Key Facility Impacts

Under the No Action Alternative, radioactive air quality impacts at the LANL site-wide and technical area levels are not discussed separately because they are accounted for in the following discussion of emissions from the Key Facilities. Radiological air emissions for the No Action Alternative are generally projected to remain at levels similar to those projected in the *1999 SWEIS* Expanded Operations Alternative.

Chemistry and Metallurgy Research Building

As a result of a decision not to move certain capabilities to the Chemistry and Metallurgy Research Building, tritium is no longer projected to be a significant emission from this building.

Radiochemistry Facility

Based on actual emissions from 1999 to 2004, the projected level of emissions from the Radiochemistry Facility has been increased by 10 percent.

Los Alamos Neutron Science Center

Projected emissions from LANSCE are determined by multiplying the microamp-hours of LANSCE operations by an emissions factor that has been developed based on stack monitoring results. Based on LANSCE emissions over recent years, the emissions factor used to estimate releases of gaseous mixed activation products has increased by a factor of about 7 from about 0.003 to 0.02 curies per microamp-hour. Therefore, the projected emissions from LANSCE are higher than previously estimated.

5.4.2.2 Reduced Operations Alternative

Key Facility Impacts

Under the Reduced Operations Alternative, radioactive air quality impacts at the LANL site-wide and technical area level are not discussed separately because they are accounted for in the following discussion of Key Facility emissions. Activities at selected Key Facilities would be reduced or eliminated from those identified in the No Action Alternative, resulting in lower emissions of radiological constituents. The lower radiological emissions would result in lower radiological doses and risks under the Reduced Operations Alternative as compared to the No Action Alternative (see Section 5.6).

High Explosives Processing and High Explosives Testing

A lower level of operations at both the High Explosives Processing and High Explosives Testing Facilities would result in a 20 percent reduction in their emissions. This reduction is shown in Table 5–12 as a reduction in emissions of uranium isotopes from 0.15 to 0.12 curies per year.

Los Alamos Neutron Science Center

The largest impact on emissions would be the cessation of LANSCE operations. The emission of particulate and vapor activation products would be reduced by about 30 curies per year; the remaining 0.014 curies per year shown on Table 5–12 would be from the Radiochemistry Facility. The shutdown of LANSCE would also eliminate the emission of about 30,400 curies per year of gaseous mixed activation products.

Pajarito Site

The cessation of operations at TA-18, in particular, shutdown of SHEBA, would result in a reduction of the remaining gaseous mixed activation product emissions (100 curies per year). Cessation of TA-18 operations is assumed to occur in 2009.

5.4.2.3 Expanded Operations Alternative

Implementation of the Expanded Operations Alternative would result in some decreases in emissions of radiological constituents associated with the closure and DD&D of certain facilities. There would also be both long-term and short-term increases in emissions. The long-term increases would be associated with higher levels of activities at certain facilities. The short-term increases could occur during construction or DD&D activities and also from actions related to the implementation of the Consent Order.

Los Alamos National Laboratory Site-Wide Impacts

Major MDA remediation, canyon cleanups and other Consent Order actions could result in temporary increases of radiological air emissions. The largest emissions would be from the remediation of the large MDAs; those are the focus of the analysis in Appendix I. Remediation of other PRSs is expected to produce less than the potential emissions from remediating the large MDAs. Emissions of radiological contaminants from remediation activities would depend on a number of factors. (Emissions from each MDA would be greatly affected by the remediation option selected with removal resulting in higher emissions than capping.) Under the removal option, varying radiological air emissions would be expected depending on the inventory of the MDA being remediated and whether or not exhumation would occur inside a containment structure equipped with a filtered exhaust system. Under the capping option, improved covers on the MDAs would reduce the potential for radiological air emissions. Remediation of an MDA would occur over a few months to several years depending on the size of the MDA and the remediation option being implemented. All of these factors would affect quantity and timing of releases of radiological constituents, resulting in variable releases over time. Although the releases would vary over time and be dependent on the remediation option selected, Section 5.6 presents an estimated dose for the option of removing all of the MDAs and the assumption that some of the removal actions would occur in a containment structure with a filtered exhaust.

Technical Area Impacts

A number of the projects analyzed in Appendices G, H, and J involve construction activities that would result in excavation activities, the DD&D of buildings, or both. These actions have the potential for minor increases in emission of radiological contaminants for short durations. The potential for these emissions would be minimized through the conduct of radiation surveys before actions begin and the use of a range of contamination control techniques which may include decontamination, application of dust suppressants, and use of containment structures. Consequently, these actions generally would not be expected to result in appreciable increases in emissions. Effects on radiological emissions associated with the TA-21 Structure DD&D are discussed as part of the Tritium Facility under the Key Facilities Impacts.

Key Facility Impacts

Under the Expanded Operations Alternative there would be both increases and decreases to projected emissions from Key Facilities. In addition, the location of some emission sources would change. As discussed above under Technical Area Impacts, construction and DD&D activities may result in minor, short-term increases in radioactive emissions. Similar minor, temporary increases in emissions may occur in connection with projects at Key Facilities.

Chemistry and Metallurgy Research Building

The Chemistry and Metallurgy Research Building Replacement TA-55 is expected to be completed and operational in 2014. With the exception of the Wing 9 hotcell, activities in the current Chemistry and Metallurgy Research Building in TA-3 would be moved into the new facility. As discussed in Appendix G, the Wing 9 hotcell capabilities would be moved to the Radiological Sciences Institute when it is available. Therefore, there would be no net change in projected radioactive emissions; however, the location of the emissions would change.

Pajarito Site

The TA-18 Pajarito Site closure would eliminate the primary source of emissions from that site, SHEBA. Therefore, starting in 2009, when SHEBA is not expected to be active at LANL, the emissions would be reduced by 100 curies per year (of argon-41) resulting in site-wide emissions of 30,400 curies per year of gaseous mixed activation products. The TA-21 Structure DD&D would include buildings that constitute part of the Tritium Facility. DD&D of structures at TA-21 would eliminate them as a source of emissions. This would reduce projected tritium emissions starting in about 2009 by 550 curies per year to 1,850 curies per year.

Plutonium Facility Complex

Addition of capabilities and increases in levels of operations under the Expanded Operations Alternative would not appreciably affect emissions from most of the Key Facilities. However, increases in the level of activities at the Plutonium Facility Complex, including producing up to 50 pits per year under single-shift operation (80 pits per year using multiple shifts), would result in a small increase in plutonium emissions. The higher level of activity would result in the annual emission of 0.00084 curies per year of plutonium as shown on Table 5–12.

Solid Radioactive and Chemical Waste Facilities

Implementing the Waste Management Facilities Transition Project (see Appendix H) could result in a temporary increase in emissions. Implementation of the project may result in the simultaneous operation of the temporary remote-handle transuranic waste retrieval facility, the new Transuranic Waste Consolidation Facility, and the existing Decontamination and Volume Reduction System (DVRS). If all three facilities operated at the same time, americium-241 emissions would increase to 1.1×10^{-5} curies per year and plutonium emissions would increase to 0.00089 curies per year. This increase could occur in the 2012 through 2015 time frame until remote-handle transuranic waste retrieval is completed and the DVRS is shut down in support of the remediation of MDA G.

5.4.3 Noise Impacts

Noise, or sound, results from the compression and expansion of air or some other medium when an impulse is transmitted through it. Sound requires a source of energy and a medium for transmitting the sound wave. Propagation of sound is affected by various factors, including meteorology, topography, and barriers. Noise is undesirable sound that interferes or interacts negatively with the human or natural environment. Noise can disrupt normal activities (for example, concentration or sleep), damage hearing, or diminish the quality of the environment.

Noise-level measurements used to evaluate the effects of nonimpulsive sound on humans are compensated by an A-weighting scale that accounts for the hearing response characteristics (frequency) of the human ear. Noise levels are expressed in decibels (dB), or in the case of A-weighted measurements, decibels A-weighted (dBA). The EPA has developed noise-level guidelines for different land use classifications (EPA 1974). The EPA guidelines identify a 24-hour exposure level of 70 dB as the level of environmental noise that will prevent any measurable hearing loss over a lifetime. Likewise, levels of 55 dB outdoors and 45 dB indoors are identified as preventing activity interference and annoyance.

Los Alamos County has promulgated a local noise ordinance that establishes noise level limits for residential land uses. Noise levels that affect residential receptors are limited to a maximum of 65 dBA during daytime hours and 53 dBA during nighttime hours between 9 p.m. and 7 a.m. Between 7 a.m. and 9 p.m., the permissible noise level can be increased to 75 dBA in residential areas, provided the noise is limited to 10 minutes in any 1 hour. Activities that do not meet the noise ordinance limits require a permit (LANL 2004e).

Noise standards related to protecting worker hearing are contained in LANL's *Noise and Temperature Stresses – Laboratory Implementation Requirements* (LANL 2003a). The occupational exposure limit for steady-state noise, defined in terms of accumulated daily (8-hour) noise exposure that allows for both exposure level and duration, is 85 dBA (LANL 2003a). When a worker is exposed for a shorter duration, the permitted noise level is increased. LANL administrative requirements also limit worker impulse/impact noise exposures that consist of a sharp rise in sound pressure level (high peak) followed by a rapid decay less than 1 second in duration and greater than 1 second apart. No exposure of an unprotected ear in excess of a C-weighted peak of 140 dB is permitted (LANL 2004e).

Noise from facility construction or operations and associated traffic could affect human and animal populations. The region-of-influence for each facility includes the site and surrounding areas, including transportation corridors, where proposed activities might increase noise levels. Transportation corridors most likely to experience increased noise levels are those roads within a few miles of the site boundary that are expected to carry most of the site's employee and shipping traffic.

Noise impacts associated with the alternatives could result from construction and operations activities, including increased traffic. Impacts of proposed activities under each alternative were assessed according to the types of noise sources and the location of the facility site locations relative to the site boundary and noise-sensitive receptors. Potential noise impacts of traffic were assessed based on the likely increase in traffic volume. Possible impacts on wildlife were evaluated based on the possibility of sudden loud noises occurring during site activities under each alternative.

Table 5–13 summarizes the expected noise impacts for each of the three alternatives.

5.4.3.1 No Action Alternative

Common to all three alternatives is LANL's continued contribution to the background noise generation within the Los Alamos County area. The background noise levels are expected to remain at or near current levels for most of the foreseeable future regardless of the alternative that is implemented. There is no single representative measurement of ambient noise available for the LANL site. For a description of existing noise levels, see Section 4.4.5.

Background levels of noise associated with LANL activities under any of the three alternatives would not likely approach the upper limit for sound levels in the community based upon site operation activities associated with each alternative relative to the existing environment.

Los Alamos National Laboratory Site-Wide Impacts

The levels of noise and short-range ground vibrations generated by environmental restoration activities are consistent with those produced by most construction activities. Heavy equipment use, such as the operation of bulldozers, loaders, backhoes, and portable generators, typically produces noise with mean levels ranging from 81 to 85 dBA at 50 feet (15 meters). For a comparison with these noise levels, normal conversation is usually conducted at a sound level of about 60 dBA (FICN 1992). If heavy machinery were to be operated over an 8-hour period producing noise at levels above 85 dBA constantly, it would be considered unsafe for workers. However, these noises are generally produced for short time periods or even sporadically. While occasional short spurts of site activities could result in noise levels in excess of 85 dBA, these are expected to be well within the levels of noise considered safe for likely exposure time durations of less than 1 hour. Hearing protection is provided and worn by workers, as appropriate, according to their standard operating procedures. Additionally, some minor interior and outdoor construction activities are common across all alternatives. Noise produced by these activities would be mostly noticed by LANL workers at the site performing those activities; these workers would also be provided with hearing protection as part of their standard operating procedures.

Table 5–13 Summary of Environmental Consequences for Noise at LANL

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site			
	Normal Operations – Noise levels from operations would continue to have little impact on the public, with the exception of sporadic noise from explosives detonation and traffic noise. Construction: – Noise impacts from construction-type activities would occur from construction, demolition, and remediation activities, and would likely have little impact on the public, except for traffic noise impacts. Land Conveyance and Transfer: – Could cause minor increases in traffic noise due to development. – Minor noise impacts could result from development. Power Grid Infrastructure Upgrade: – Minor noise impacts would result from construction. Wildfire Hazard Reduction Program: – Minor noise impacts would result from activities and disposition of flood and sediment retention structures. – Minor noise impacts would result from the Trails Management Project and the Security Perimeter Project.	Same as No Action Alternative	Same as No Action Alternative, plus: Security-Driven Transportation Modifications: – Minor noise impacts would result from road, bridge, and walkway construction. – Minor increases in traffic noise could result from use of the new roads, especially at the Royal Crest Mobile Home Park under one of the options. MDA Remediation: – Minor noise impacts from remediation activities near the LANL boundary could cause some public annoyance. – Minor to moderate increase in truck and personnel vehicle traffic noise could result along East Jemez Road and at White Rock under the various remediation options.
Affected Technical Areas			
TA-3	– Minor change in noise impacts from operation of new turbine generator. – Minor construction noise impacts from constructing 3 new office buildings. – Negligible operation noise impacts from new office buildings.	Same as No Action Alternative	Same as No Action Alternative, plus: – Minor construction equipment and traffic noise impacts from constructing Center for Weapons Physics Research and Replacement Office Buildings. – Negligible operational noise impacts from equipment at Center for Weapons Physics Research and Replacement Office Buildings.
TA-21	No change in noise impacts	Same as No Action Alternative	Minor construction equipment noise impacts from DD&D of structures. Some increase in traffic noise from waste shipments.
TA-54	Minor noise impacts would result from MDA H closure activities.	Same as No Action Alternative	Same as No Action Alternative
TA-72	No change in noise impacts	Same as No Action Alternative	Minor construction equipment and traffic noise from constructing Remote Warehouse and Truck Inspection Station. Possible noticeable noise to public along East Jemez Road from

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
			operation of Remote Warehouse and Truck Inspection Station.
Key Facilities			
Chemistry and Metallurgy Research Building Replacement (TA-3, TA-48, and TA-55)	– Little or no change in impacts from Chemistry and Metallurgy Research Building Replacement operation when moved to TA-55. – Minor construction equipment and traffic noise impacts from DD&D of old facility at TA-3 and construction of new facility at TA-55.	Same as No Action Alternative	Same as No Action Alternative
High Explosives Processing Facility	– No change in operation noise impacts. – Minor construction equipment and traffic noise impacts from TA-16 Engineering Complex and demolition of structures.	Same as No Action Alternative	Same as No Action Alternative
High Explosives Testing Facility	– No change in operation noise impacts. – Minor construction equipment and traffic noise impacts from construction of 15 to 25 new structures (new offices, laboratories, and shops) within the new Science Complex to replace about 59 structures currently used for dynamic experimentation operations, and removal or demolition of vacated structures.	Minor reduction in operation noise impacts from 20 percent reduction in activities. Same as No Action Alternative for construction.	Same as No Action Alternative
Tritium Facility (TA-21)	No change in noise impacts	Same as No Action Alternative	– Minor construction equipment and traffic noise impacts from DD&D of all TA-21 tritium buildings as part of the project to decommission all of TA-21.
Pajarito Site (TA-18)	No change in noise impacts	Minor reduction in operation noise impacts from shut down of activities.	– Minor reduction in operation noise impacts from shut down of activities. – Minor construction equipment and traffic noise impacts from DD&D of TA-18 buildings.
Target Fabrication Facility	No change in noise impacts	Same as No Action Alternative	Same as No Action Alternative
Bioscience Facilities	No change in noise impacts	Same as No Action Alternative	– Negligible change in operation impacts with transfer of the Bioscience Facilities operations to the new Science Complex. – Minor construction noise impacts from construction of the new Science Complex.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Radiochemistry Facility (TA-48)	No change in noise impacts	Same as No Action Alternative	– Minor construction equipment and traffic noise impacts from construction of the new Radiological Sciences Institute (see Appendix G).
Radioactive Liquid Waste Treatment Facility (TA-50)	No change in noise impacts	Same as No Action Alternative	– Minor construction equipment and traffic noise impacts from construction of a replacement for the existing Radioactive Liquid Waste Treatment Facility at TA-50 (see Appendix G) and DD&D of existing Radioactive Liquid Waste Treatment Facility.
LANSCE (TA-53)	No change in noise impacts	Minor reduction in noise impacts from shutdown.	Negligible to minor noise impacts from refurbishment.
Solid Radioactive and Chemical Waste Facilities (TA-50 and TA-54)	No change in noise impacts	Same as No Action Alternative	– Minor noise impacts from retrieving transuranic waste from below ground storage. – Minor construction and traffic noise impacts from construction of a new Transuranic Waste Processing Facility (as described in Appendix H) and new access control station, low-level radioactive waste compactor building, and low-level radioactive waste certification building.
Plutonium Facility Complex (TA-55)	No change in noise impacts	Same as No Action Alternative	– Minor construction equipment and traffic noise impact from minor facility modifications in support of increased pit production and Plutonium Complex Refurbishment Project, and constructing radiography capabilities (see Appendix G).

MDA = material disposal area, TA = technical area, DD&D = decontamination, decommissioning, and demolition, LANSCE = Los Alamos Neutron Science Center.

Noise from LANL construction-type activities may be somewhat noticeable to nearby members of the public. Environmental restoration activities that occur at the Los Alamos townsite may be noticeable to the public but would be limited in duration. Because these activities are conducted during the daytime hours for short continuous durations, the noise levels and ground vibrations produced would not likely result in an adverse impact to the public. Nor are the noise levels likely to adversely affect sensitive wildlife receptors or their habitat. If certain sensitive wildlife species are found to occupy habitat areas near locations where these types of activities need to occur, or if the occupancy status of these habitat areas is unknown, these activities would need to be scheduled outside of the species' breeding season, or else, other special protective measures would need to be planned and implemented (such as hand digging).

Specifically for the No Action Alternative, minor noise impacts would occur from construction-type activities, including the construction of previously approved projects such as the Power Grid Infrastructure Upgrade, Wildfire Hazard Reduction Program activities, disposition of flood and sediment retention structures, activities related to the Trail Management Project, and construction for the Security Perimeter Project. These construction projects would result in temporary increases in noise from equipment and traffic.

Similarly, workers, the public or sensitive wildlife receptors would not likely be adversely impacted by explosives testing that is common to some degree over the three alternatives. Workers are allowed to experience impulsive/impact noise events up to a maximum of 140 dBC and are kept away from harmful noise levels and air blasts by gated exclusion zones that control their entry into explosives firing site detonation points. The public is not allowed within the fenced technical areas that have firing sites, and noise levels produced by explosives tests are sufficiently reduced at locations where the public would be present to preclude hearing damage. Such tests would not be expected to adversely affect offsite sensitive receptors (such as those at Bandelier National Monument or at White Rock). Noises heard at that distance would be similar to thunder in intensity, and air blast and ground vibrations are not expected to be present offsite of LANL at intensities great enough to adversely affect real properties. Sensitive wildlife species would not likely be adversely affected by "thunder-like" explosives testing events given their continued presence in areas over parts of the country that are known to be within higher-than-average lightning event areas, and their continued presence at LANL over the past 10 years. In fact, the continued well being of LANL's resident and long-term migratory populations of these sensitive species indicates that the level of noise generated by explosives testing under the No Action Alternative is at least tolerable by these particular species.

Implementing the No Action Alternative would likely result in the previously discussed operation effects common to all alternatives. Specifically for the No Action Alternative, a minor increase in vehicle noise could result from development that occurs under land conveyance and transfer.

Technical Area Impacts

Minor construction-related noise impacts would occur from the construction of 3 new office buildings at TA-3 and MDA H closure activities at TA-54. Minor operations-related noise impacts would occur as a result of operation of new office buildings at TA-3 and operation of the new turbine generator at TA-3.

Key Facilities Impacts

Minor construction-related noise impacts would occur from the operation of construction equipment for the construction of the Chemistry and Metallurgy Research Building Replacement at TA-55, demolition of facilities at TA-3, completion of the TA-16 Engineering Complex, demolition of structures at TA-16, construction of buildings at the new Science Complex site, and demolition of unneeded structures.

Minor operations-related noise impacts would occur from moving Chemistry and Metallurgy Research operations from TA-3 to TA-55, and from the operation of heating, ventilation, and cooling systems, and other equipment at other new facilities including new structures for dynamic explosion operations and a new dynamic explosion structure at TA-15 associated with High Explosives Testing.

5.4.3.2 Reduced Operations Alternative

Noise impacts resulting from activities associated with the No Action Alternative would still occur except for those associated with reductions to operations considered as part of the Reduced Operations Alternative.

Los Alamos National Laboratory Site-Wide Impacts

Construction-related noise impacts under the Reduced Operations Alternative would be similar to those under the No Action Alternative. Construction projects would result in temporary increases in noise from equipment and traffic.

The operations-related noise impacts under the Reduced Operations Alternative would be similar to the No Action Alternative. The primary noise, air blast waves, and ground vibration impacts from the implementation of this alternative would be generated by the high explosives tests. There would be fewer of these explosions under the Reduced Operations Alternative, and the resulting noise would still be occasional (rather than continuous) events. Effects would be similar to those currently generated whenever there is a high explosives test. Noises associated with LANSCE and TA-18 operations would be eliminated with the shut down of those facilities.

Technical Area Impacts

Construction- and operations-related noise impacts would be the same as under the No Action Alternative.

Key Facilities Impacts

Noise impacts from construction equipment and traffic from Key Facilities would be the same as under the No Action Alternative. A minor reduction in operational noise impacts would occur from the reduction in high explosives testing, and the shut down of activities at TA-18 (Pajarito Site), and LANSCE at TA-53.

5.4.3.3 Expanded Operations Alternative

Noise impacts associated with activities considered under the No Action Alternative would still occur under the Expanded Operations Alternative.

Los Alamos National Laboratory Site-Wide Impacts

Under the Expanded Operations Alternative, there would be an increase in the amount of interior and outdoor construction activities at LANL. These would individually be within the level of effects described for the No Action Alternative, but could be ongoing for a longer total period of time. In addition to the construction activities discussed for the No Action Alternative, construction of various new buildings in various technical areas; DD&D of buildings; road, bridge, and walkway construction under the Security-Driven Transportation Modifications; and MDA remediation as described and discussed in Appendix I, would likely result in levels of noise and short-range ground vibrations similar to those associated with current construction and demolition activities. Workers would be primarily affected by these noises, although motorists could occasionally hear low levels of equipment noises along Pajarito Road under certain climatic conditions. The roadway, walkway, and bridge construction under the Security-Driven Transportation Modifications (Appendix J) would be short term and similar to other roadway construction at LANL. Activities at MDAs which are close to the site boundary, such as at TA-21, could result in increases in noise levels sufficient to result in increased annoyance at nearby residences or businesses.

There would be no change in noise impacts to the public outside of LANL as a result of construction activities, except for a small increase in traffic noise levels from construction employees' vehicles, materials shipment, and a minor to moderate increase in truck traffic noise from the MDA remediation options, especially along East Jemez Road near the Royal Crest Mobile Home Park. Other proposed construction activities under this alternative would include small-scale outdoor activities, work interior to existing buildings, construction of an addition to an existing building, construction of a new building within close proximity to others, and construction at specific technical areas and Key Facilities described below. Effects of these construction activities would be primarily limited to involved workers and would not likely result in any adverse effect on sensitive wildlife species or their habitat.

The largest increases in traffic noise from construction type activities would be associated with remediation of MDAs. Estimated increases in traffic along Pajarito Road could be substantial during years when remediation of MDA G is occurring. A similar increase in traffic along Route 4 at White Rock could be expected. The associated increase in traffic noise may be noticeable to some residents at White Rock due to the increase in truck trips. Since most of the truck trips are expected to occur during non-peak traffic daytime hours, the truck noise levels would be higher during these hours. Since most of the increase in traffic would be from personnel vehicles, much of the increase in traffic and associated traffic noise would occur during the peak traffic hours. Increases in traffic along East Jemez Road, near the Royal Crest Mobile Home Park, could also be substantial during years when remediation of MDA G (capping and removal options) is occurring. The associated increase in traffic noise may be noticeable to residents at the Royal Crest Mobile Home Park due to the increase in truck and personnel vehicle trips.

As discussed in the No Action Alternative, the primary noise from the implementation of these alternatives would be generated by the air blast waves and ground vibration impacts associated with high explosives tests, although these explosions and the resulting noise would still be occasional (rather than continuous) events. The noise would be sporadic and would be mitigated by the distance of the tests to the nearest public receptors. Effects of these operational activities would be primarily limited to involved workers and would not likely result in any adverse effect on sensitive wildlife species or their habitat, similar to the effects discussed under the No Action Alternative.

A minor increase in vehicle noise could result from use of the new roads constructed under the Security-Driven Transportation Modifications, especially at the Royal Crest Mobile Home Park under one of the options being considered that would include a bridge across Sandia Canyon.

Technical Area Impacts

There would be no change in noise impacts to the public outside of LANL as a result of construction activities at specific technical areas (TA-3, TA-18, TA-21, and TA-54), except for a minor increase in traffic noise levels from construction employees' vehicles and materials shipment and a minor increase in noise levels at nearby businesses from DD&D at TA-21. Construction noise impacts would result from the same activities as under the No Action Alternative, with impacts from construction of additional office buildings and the Center for Weapons Programs Research at TA-3, minor impacts from DD&D of TA-18 buildings, DD&D at TA-21 and construction of the Remote Warehouse Truck Inspection Station. Effects of these construction activities would be primarily limited to involved workers and would not likely result in any adverse effect on sensitive wildlife species or their habitat.

Operational noise impacts would occur from the same type of activities as under the No Action Alternative, with minor changes to impacts from relocated and consolidated activities across the various technical areas. Possible noticeable noise to the public along East Jemez Road could occur from operations of the Remote Warehouse Truck Inspection Station.

Key Facilities Impacts

There would be no change in noise impacts to the public outside of LANL as a result of construction-type activities at Key Facilities, except for a small increase in traffic noise levels from construction-type employees' vehicles and materials shipment. Construction noise impacts from Key Facilities would be the same as under the No Action Alternative, with minor impacts from DD&D of TA-21 and TA-18 buildings; construction of the new Science Complex, new Radiological Sciences Institute, and Institute for Nuclear Nonproliferation Science and Technology; replacement of RLWTF at TA-50; DD&D of existing RLWTF; retrieval of transuranic waste from below ground storage at Solid Radioactive and Chemical Waste Facilities; construction of a new Transuranic Waste Processing Facility and associated buildings; and minor facility modifications at TA-55. Effects of these activities would be primarily limited to involved workers and would not likely result in any adverse effect on the public, or on sensitive wildlife species or their habitat. Traffic noise would increase in the area around LANL from increased numbers of employee vehicles and shipments of materials and wastes as discussed in the site-wide section.

Operational noise impacts for Key Facilities would result from the same activities as under the No Action Alternative, except for a minor reduction in operational impacts from the removal of activities from TA-18 and minor changes in impacts from the transfer of the Bioscience Facilities operations to the new Science Complex, and operations of the Radiological Sciences Institute, the replacement RLWTF, the new Transuranic Waste Processing Facility, and new office buildings at TA-55. Noise impacts, therefore, from Key Facilities operations would likely be about the same as for the No Action Alternative for activities associated with the Expanded Operations Alternative.

5.5 Ecological Resources

Ecological resources include terrestrial resources, wetlands, aquatic resources, and protected and sensitive species. Biological data from the *1999 SWEIS* and other environmental documents, wetlands surveys, and plant and animal inventories of LANL were reviewed in order to identify the locations of plant and animal species and wetlands. Lists of protected and sensitive species potentially present on LANL were developed from sources at the Federal, state, and site levels.

Impacts to ecological resources could occur as a result of land disturbance, water use and discharge, human activity, and noise associated with project implementation. Each of these factors was considered when evaluating potential impacts from a Proposed Action. For those alternatives involving construction of new facilities, direct impacts to ecological resources were based on the acreage of land disturbed by construction. Indirect impacts from factors such as human disturbance and noise were evaluated qualitatively. Indirect impacts to ecological resources from construction due to erosion were evaluated qualitatively, recognizing that standard erosion and sediment control practices would be followed.

Of particular importance in evaluating potential impacts on protected and sensitive species is the effect that a proposed project could have on the species' habitat. Accordingly, LANL has established Areas of Environmental Interest for three species – the southwestern willow flycatcher (Federal and state endangered), bald eagle (Federal and state threatened), and Mexican spotted owl (Federal threatened and state sensitive) (LANL 2000e). Areas of Environmental Interest for these species include core and buffer zones, each of which has certain restrictions aimed at protecting both the species and its habitat. Accordingly, impacts to the bald eagle, southwestern willow flycatcher, and Mexican spotted owl were evaluated based on whether a proposed project, or a project element, would affect either of these zones.

This section addresses the impacts of the No Action, Reduced Operations, and Expanded Operations Alternatives on Ecological Resources. A summary of impacts is presented in **Table 5–14**.

Table 5–14 Summary of Environmental Consequences of Ecological Resource Changes at Los Alamos National Laboratory

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
	LANL Site		
	Land Conveyance and Transfer: – 2,255 acres (913 hectares) of land within the piñon-juniper woodland and ponderosa pine forest zones have been conveyed or transferred. – 770 acres (312 hectares) of habitat could be developed. – Transfer of resource protection responsibility could result in a less rigorous environmental and protection review process. Power Grid Upgrades: – Minimal effects on vegetation. – Temporary impacts such as disturbance from construction activities, on wildlife. – Potential positive impact by providing perching sites for larger birds. Wildfire Hazard Reduction Program: – Short-term disturbance of wildlife due to forest thinning activities. – Recreate more natural historic forest conditions. – Increased forest health could benefit the Mexican spotted owl and other species. Disposition of Flood Retention Structures: – Short-term disturbance of wildlife due to construction activities. – Potential minor impacts on downstream wetlands. Trails Management Program: – Short-term disturbance of wildlife due to implementation activities. – Where trails are closed, some increase in diversity of wildlife.	Same as No Action Alternative	Same as No Action Alternative, plus: MDA Remediation Project: – Minimal temporary impact on wildlife during capping or waste removal. – Capping would reduce biointrusion and complete removal would eliminate it. – Capping would limit revegetation efforts, while there would be no restrictions under the removal option. – Possible loss of habitat at borrow pit in TA-61. Security-Driven Transportation Modifications Project: – Parking lot construction and placement of pedestrian and vehicle bridges under all alternatives would remove 30 acres (12 hectares) of natural vegetation. – A section of new roadway under one Auxiliary Action B would remove about 1.3 acres (0.5 hectare) of natural habitat plus additional limited acreage for the bridge footings, if built. – Bridges and traffic over the core zone of the Sandia-Mortandad Canyon Mexican spotted owl AEI have the potential to cause long-term impacts. Section 7 consultation with the U.S. Fish and Wildlife Service would be needed.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Affected Technical Areas			
TA-3	No change in impacts to ecological resources.	Same as No Action Alternative.	Replacement office buildings: – Clear 13 acres (5.3 hectares) of mixed conifer forest. – Short-term construction impacts on wildlife.
TA-21	No change in impacts to ecological resources.	Same as No Action Alternative.	TA-21 DD&D: – Short-term construction impacts on wildlife in adjacent areas.
Key Facilities			
Chemistry and Metallurgy Research (TA-3, TA-48, and TA-55)	Limited acreage of ponderosa pine forest cleared with loss and displacement of associated wildlife.	Same as No Action Alternative.	Same as No Action Alternative.
High Explosives Testing Facility (TA-6, TA-22, and TA-40)	Short-term impacts on wildlife from construction of new facilities and demolition of old structures.	Same as No Action Alternative, plus: – Reduction in the number of times animals would be subjected to stress resulting from explosives testing.	Same as No Action Alternative.
Pajarito Site (TA-18)	No change in impacts to ecological resources.	– Same as No Action Alternative	– Minor impact to wildlife during demolition. – Restoration of site could create a more natural habitat and benefit wildlife, potentially including the Mexican spotted owl.
Radiochemistry Facility (TA-48)	No change in impacts to ecological resources.	Same as No Action Alternative.	– Minor impact to wildlife during construction and demolition. – 12.6 acres (5.1 hectares) of ponderosa pine forest cleared.
Radioactive Liquid Waste Treatment Facility (TA-50)	No change in impacts to ecological resources.	Same as No Action Alternative.	– New evaporation basins, if built, would disturb 4 acres (1.6 hectares) of primarily open field habitat within both the buffer and core zone of the Sandia and Mortandad Canyon Areas of Environmental Interest for the Mexican spotted owl. – Implementation of the evaporation basin option would reduce wetlands and riparian habitat in Mortandad Canyon and the abundance and diversity of Mexican spotted owl prey species.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Solid Radioactive and Chemical Waste Facilities (TA-50 and TA-54)	No change in impacts to ecological resources.	Same as No Action Alternative.	− Short-term impacts on wildlife from new construction and demolition in TA-54 and TA-50 under both alternatives. − Activities could occur in Areas of Environmental Interest for the Mexican spotted owl or the willow flycatcher.
LANSCE (TA-53)	No change in impacts to ecological resources.	Wetland reduction possible due to shut down.	Same as No Action Alternative.
Bioscience Facilities	No change in impacts to ecological resources.	Same as No Action Alternative.	The Science Complex Project includes: − Options 1 and 2 would remove 5 acres (2 hectares) of ponderosa pine forest. − Under Option 3 less than 5 acres (2 hectares) of grassland and forest would be cleared. − Short-term construction impacts on wildlife.
Remote Warehouse and Truck Inspection Station (TA-72)	No change in impacts to ecological resources.	Same as No Action Alternative.	The Remote Warehouse Project includes: − 4 acres (1.6 hectares) of ponderosa pine forest and pinion-juniper woodland would be cleared. − Short-term construction impacts on wildlife.

MDA = material disposal area; AEI = Areas of Environmental Interest; TA = technical area; DD&D = decontamination, decomlmissioning, and demolition; LANSCE = Los Alamos Neutron Science Center.

5.5.1 No Action Alternative

The No Action Alternative is represented by the existing environment as it relates to ecological resources (see Sections 4.4.5 [for effects of explosives-related noise on wildlife] and 4.5) together with actions that will be implemented, based on other NEPA compliance reviews issued since the *1999 SWEIS*. Impacts to ecological resources are described in terms of those projects that impact the site as a whole and those that affect specific technical areas. Key Facilities are addressed separately. Only those projects that have been evaluated as having an impact on ecological resources are addressed below.

Los Alamos National Laboratory Site-Wide Impacts

Five projects that have been approved, and for which NEPA documentation has been prepared since publication of the *1999 SWEIS*, that have potential impacts across a number of technical areas. These projects are addressed separately below.

The conveyance and transfer of land from DOE to Los Alamos County and the Department of the Interior to be held in trust for the Pueblo of San Ildefonso began in 2002, and, by the end of 2005, 2,255 acres (913 hectares) had been turned over (see Section 4.5). Additional acreage must be turned over by 2007. The land that has been, or is to be, turned over falls within the piñon-juniper woodland and ponderosa pine forest zones. Direct impacts of the conveyance and transfer include changes in responsibility for resource protection. The analysis determined indirect impacts included future development within the conveyed and transferred parcels. Approximately 770 acres (312 hectares) of relatively undisturbed habitat within the ponderosa pine forest and piñon-juniper woodland could be developed. Habitat modification resulting from development could affect potential habitats for several Federal-listed threatened and endangered species including the Mexican spotted owl; and, in some tracts, wetlands could be reduced or possibly lost, with potential increased downstream and offsite sedimentation. Additional indirect impacts of the land conveyance and transfer could result in a much less rigorous environmental and protection review process for future activities because neither the County of Los Alamos nor the Pueblo of San Ildefonso have regulations that would match the Federal review and protection process. Cumulatively, development could impact biodiversity as a result of fragmentation of habitat and disruption of wildlife migration corridors (DOE 1999d).

Electric power line upgrades were determined to have minimal effects on vegetation along the right-of-way. Impacts on wildlife during construction would include displacement due to increased noise and human activity; however, some species would likely return to the new habitat within the proposed corridor, including deer and elk. Further, the power line may provide additional perching sites for larger birds that occupy or use the area through which it passes. Possible adverse effects on potential habitat for bald eagles, southwestern willow flycatchers, and Mexican spotted owls would not be expected due to the proposed placement of structures, roads, and laydown areas in existing roadways or disturbed areas. Timing of actions during construction and maintenance to avoid adverse effects on sensitive species or their habitats would ensure that these species were not impacted (LANL 2000e).

The Wildfire Hazard Reduction Program would, in the long term, create conditions at LANL that are consistent with a more natural historic ecological process with accompanying improved

health and vigor and with increased biological diversity. In the short-term, treatment measures would temporarily displace local wildlife such as deer, elk, birds, and small mammals. However, wildlife would return to treated forests, and their numbers would likely increase on a long-term basis. A general improvement in forest health would also be expected to benefit sensitive species. In fact, the goal of reducing the risk of severe, high-intensity wildfires supports the recovery goals for the Mexican spotted owl (DOE 2000e).

The future disposition of certain flood and sediment retention structures built after the Cerro Grande Fire could have minor short-term effects on ecological resources. The demolition of the flood retention structure in Pajarito Canyon would disturb vegetation and could potentially result in sedimentation of downstream wetlands. Also, noise and other activities associated with demolition could temporarily disperse animals that use the area. Revegetation and implementation of best management practices would minimize impacts to terrestrial resources and wetlands. Constraints on the timing of activities and noise levels may be required if Mexican spotted owls were found in the area. Removal of the steel diversion wall upstream of TA-18 could cause temporary, short-term effects on plants and animals. Noise and activity constraints during the breeding season of the Mexican spotted owl would prevent adverse effects on the nearby Area of Environment Interest if the area were to become occupied by that species. Activities taking place at the low-head weir, located in Los Alamos Canyon, and the road reinforcements in Twomile Canyon, Pajarito Canyon, and Water Canyon were found not to affect ecological resources (DOE 2002i).

No long-term or permanent changes to ecological resources would be expected from implementing the LANL Trails Management Program. However, short-term temporary effects on animals that live along trail reaches could result from trail construction, maintenance, or closure activities. In areas where trails would be closed, some increase in animal diversity might occur. Sensitive species, including the Mexican spotted owl, would not likely be adversely affected, nor would their critical habitat be adversely affected, by activities associated with the Trails Management Program (DOE 2003d).

Technical Area Impacts

TA impacts on ecological resources would be essentially unchanged from current conditions under the No Action Alternative.

Key Facilities Impacts

Since the publication of the *1999 SWEIS*, NEPA compliance has been completed for two currently active projects related to Key Facilities that could potentially affect ecological resources. They are the Chemistry and Metallurgy Research Building Replacement at TA-55 and the Twomile Mesa Complex Consolidation at TA-22.

Chemistry and Metallurgy Research Building

The Chemistry and Metallurgy Research Building Replacement would be built within TA-55 on both previously disturbed land and within a small area of ponderosa pine forest. A total of about 28 acres (11 hectares) of natural vegetation would be removed. However, some of this land has

been previously disturbed. Where construction would occur on previously disturbed land, there would be little or no impact to terrestrial resources. Construction would remove some previously undisturbed ponderosa pine forest, resulting in the loss of less mobile wildlife such as reptiles and small mammals, and causing more mobile species, such as birds or large mammals, to be temporarily displaced. Indirect impacts from construction, such as noise or human disturbance, could also impact wildlife living adjacent to the construction zone. The project would have no impact on wetlands or aquatic resources at LANL. Although TA-55 includes a portion of the buffer zone of the Pajarito Canyon Mexican spotted owl Area of Environment Interest, construction of the Chemistry and Metallurgy Research Building Replacement is not expected to adversely affect it. Operational impacts were determined to be minimal (DOE 2003f). DD&D of the existing CMR Building would allow that site to be revegetated. However, as the site is within TA-3, infill building at a later date would likely occur.

High Explosives Testing

Construction of the new facilities associated with the consolidation of activities at the Twomile Mesa Complex within TA-22 and the associated demolition of numerous structures within a number of technical areas across LANL were determined to have minimal impact on ecological resources. Small mammals and birds would be temporarily displaced by construction activities, but they would likely return to the area after construction was completed. Movement of large mammals is not likely to be altered. Also, there would be no impacts to wetlands or sensitive species (DOE 2003g).

5.5.2 Reduced Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Under the Reduced Operations Alternative, impacts on ecological resources would be the same as for the No Action Alternative (see Section 5.5.1).

Key Facilities Impacts

Activity levels at certain Key Facilities would change. High explosives processing and testing would be reduced by 20 percent, LANSCE would cease operation and be placed into a safe shutdown mode, and operations would cease at the Pajarito Site (TA-18) and that facility would also be shut down. Since there would be no change in impacts on ecological resources associated with the closure of LANSCE or TA-18 facilities, this action is not addressed further.

High Explosives Testing

Under the Reduced Operations Alternative, high explosives testing at LANL would be reduced by 20 percent. Although animals may adjust to constant noise levels, they do not readily adjust to intermittent high levels of noise. Startle or fright is the immediate behavioral reaction to transient, unexpected or unpleasant noise such as explosives testing (EPA 1980). Thus, although there would be a reduction in testing, animals residing near test sites would still experience stress with the occurrence of each test; the overall number of times per year that this stress would be experienced would, however, be lessoned.

5.5.3 Expanded Operations Alternative

The Expanded Operations Alternative reflects proposals that would expand the overall operations level at LANL above those established for the No Action Alternative. Thus, this alternative includes ecological resource impacts for those actions addressed under that alternative (see Section 5.5.1). Additionally, the Expanded Operations Alternative includes a number of new projects that have the potential to impact ecological resources. Not all new projects would affect these resources since many would involve actions within, or modifications to, existing structures, or construction of new facilities within previously developed areas of LANL. Only those projects that would likely impact ecological resources are addressed below.

Los Alamos National Laboratory Site-Wide Impacts

There are two options (capping and removal) related to the remediation of MDAs at LANL. Under the Capping Option, terrestrial resources would be disrupted as the MDAs are cleared of existing vegetation and then capped. (Additionally, the need to provide material for the caps could result in the loss of some habitat adjacent to the active portion of the borrow pit in TA-61 due to the need to enlarge the existing borrow area.) At most sites, this would have minimal biota impact, since the MDAs are grassy areas enclosed within a fence that excludes most wildlife species except birds and very small animals. Noise and human presence during remediation could disturb wildlife in adjacent areas. Proper maintenance of equipment and restrictions preventing workers from entering adjacent undisturbed areas would lessen these impacts. Caps would be designed to prevent or reduce biointrusion; thus, ecological risks from contaminants being reintroduced into the environment would be reduced under this option. Once capped and revegetated, the MDAs would provide habitat similar to that which existed prior to remedial actions being implemented.

This option would not directly impact any wetlands or aquatic resources at LANL. Although some of the MDAs and the borrow pit fall within core and buffer zones of the Mexican spotted owl, only MDA D within TA-33 includes part of the core zone for the White Rock Canyon Bald Eagle Area of Environmental Interest. None of the MDAs or the borrow pit are within the southwestern willow flycatcher Area of Environmental Interest. Direct impacts to the spotted owl and bald eagle would not be expected as a result of remediation activities because the presence of these sensitive species is unlikely at any of the disturbed areas under consideration; species-specific surveys would be performed to determine their presence prior to initiation of field work. Indirect impacts would be prevented through implementation of the procedures set forth in the LANL *Threatened and Endangered Species Habitat Management Plan* (LANL 2000b). Remediating the other PRSs at LANL may also cause disruption of ecological resources, although such disruption would again be temporary and could be mitigated by implementation of existing LANL procedures.

Impacts to ecological resources under the MDA Removal Option would be similar to those described above. While short-term remedial actions would create a disruptive environment for local wildlife, long-term impacts would likely be beneficial in terms of ecological risk, since wastes would be removed. Also, there would be no restriction on the types of plants that could be introduced, permitting the reestablishment of more natural conditions that would, in turn, provide habitat for area wildlife (see Appendix I).

Most actions associated with implementing the Security-Driven Transportation Modifications Project would have little or no impact on ecological resources; however, the construction of the two parking lots, a portion of the new road across TA-63, and the highway and pedestrian bridges over the branch of Mortandad Canyon would affect undeveloped ponderosa pine forest, open land, and associated wildlife. Other project elements would largely take place in currently developed areas. Considering the lack of wetlands within the Pajarito Corridor West and the fact that aquatic resources are not present on the mesa, impacts to these resources would not occur. Although the parking lot in TA-63, the road across the eastern edge of TA-63, and the pedestrian and highway bridges fall within the Sandia-Mortandad, Pajarito Canyon, or Threemile Canyon Mexican spotted owl Area of Environmental Interest buffer zones, none of these areas are within core areas. Indirect impacts to the Mexican spotted owl would be prevented through implementation of the procedures set forth in the LANL *Threatened and Endangered Species Habitat Management Plan* (LANL 2000b).

One option for the Security-Driven Transportation Modifications Project involves construction of a two-lane bridge within a 1,000-foot (300-meter) wide corridor across Mortandad Canyon and a new two-lane road from the north end of the new bridge westward through TA-60 to connect TA-35 with TA-3. A second option involves construction of a new two-lane bridge that would be constructed within a 1,000-foot (300-meter) wide corridor across Sandia Canyon and a new two-lane road from the new bridge to connect with East Jemez Road. Construction of the roadways would have minimal impact on habitat since they would generally follow existing rights-of-way which have already been disturbed. However, the road to be constructed for the second option would require the clearing and grading of approximately 1.3 acres (0.5 hectares) of ponderosa pine forest. No wetlands or aquatic resources would be directly affected by roadway construction.

Under both options, road and bridge construction would take place within the buffer zone of the Sandia-Mortandad Canyon and Los Alamos Canyon Mexican spotted owl Area of Environmental Interest. Additionally, they would pass through the core zone of the Sandia-Mortandad Canyon Mexican spotted owl Area of Environmental Interest. If surveys conducted prior to construction identified owls within the core zones, restrictions would be implemented according to the LANL *Threatened and Endangered Species Habitat Management Plan* (LANL 2000b). Following construction of one or both bridges, their presence, as well as traffic generated noise and light, would have the potential to impact core zone habitat and prevent owls from using the area. Thus, prior to construction, Section 7 (of the Endangered Species Act) consultation with the U.S. Fish and Wildlife Service will be required. This process would necessitate the preparation of a biological assessment by DOE for the purpose of analyzing potential effects of the project on the owl or its habitat. This would be followed by the issuance of a biological opinion on the project by the U.S. Fish and Wildlife Service, which could propose reasonable and prudent alternatives to the proposed bridges.

Technical Area Impacts

Two projects are being planned that have potential impacts on ecological resources within TA-3 and TA-21. These are addressed below.

Technical Area 3

Construction of the Replacement Office Building Project would involve the clearing and grading of 13 acres (5.3 hectares) of mixed conifer forest within TA-3. This would result in the loss of less mobile wildlife such as reptiles and small mammals, and cause more mobile species, such as birds or large mammals, to be displaced. Construction of the new buildings and parking lot would not impact wetlands since none are located in or near the construction zone. Direct impacts to the Mexican spotted owl, southeastern willow flycatcher, and bald eagle would not be expected since the work area does not fall within the core zone of any Area of Environmental Interest. However, the Replacement Office Building complex is located partially in the buffer zone of the Los Alamos Canyon Mexican spotted owl Area of Environmental Interest. Indirect impacts to the owl from noise and light would be prevented through implementation of the procedures set forth in the *LANL Threatened and Endangered Species Habitat Management Plan* (LANL 2000b). Operation of the Replacement Office Building Project would likely have minimal impact on terrestrial resources within or adjacent to TA-3 (see Appendix G.2).

Technical Area 21

The DD&D of structures at TA-21 would take place within the highly disturbed industrial portion of the TA which contains little wildlife habitat. Demolition related disturbances to wildlife would likely be intermittent and localized. Upon DD&D of the buildings and structures, the site would be contoured and revegetated. However, revegetation would have only relatively short-term benefits to wildlife since both the parcel that has been conveyed to Los Alamos County and the parcel retained by DOE could be developed in the future. DD&D activities within TA-21 would have the potential to impact wetland areas by increasing runoff and siltation; however, best management practices should prevent any such impacts. The elimination of two NPDES-permitted outfalls associated with TA-21 operations would reduce the quantity of surface water discharge to the adjacent canyons. DD&D activities at TA-21 would not be expected to directly impact Mexican spotted owl potential habitat nearby since all activities would take place within developed portions of the TA. Indirect impacts would be prevented through implementation of the procedures set forth in the LANL *Threatened and Endangered Species Habitat Management Plan* (LANL 2000b).

Key Facilities Impacts

Four projects are being planned that are related to Key Facilities at LANL.

Radiochemistry Facility

Although construction of some of the new facilities associated with the Radiological Sciences Institute would take place on previously disturbed land, it would be necessary to clear about 12.6 acres (5.1 hectares) of ponderosa pine forest at TA-48, which would directly and indirectly impact area wildlife. Construction of the Radiological Sciences Institute would not directly impact wetlands located in Mortandad Canyon, or the small wetland situated between TA-48 and TA-55 and best management practices would reduce the potential for indirect impacts. There would be no impact to aquatic resources from construction and operation of the Radiological Sciences Institute. Direct impacts to the Mexican spotted owl are unlikely, as the construction zone does not include any part of the core area of either the Sandia-Mortandad Canyon or

Pajarito Canyon Area of Environmental Interest. Indirect impacts from excess noise and light would be prevented through implementation of the procedures set forth in the LANL *Threatened and Endangered Species Habitat Management Plan* (LANL 2000b). A summary of this plan is provided in Section 4.5.4.

The removal of existing buildings and structures at TA-48, as well as those that the Radiological Sciences Institute is to replace, would generate increased noise and levels of human disturbance. However, impacts would be temporary and would likely have minimal effect on wildlife since these structures exist within previously disturbed areas and wildlife in adjacent areas is accustomed to human activity. Since wetlands do not exist in the immediate area of any of the buildings to be removed in association with the new Radiological Sciences Institute, there would be no direct impacts on this resource. While demolition would not impact the Mexican spotted owl directly, indirect impacts from excess noise and light are possible. Such impacts would be avoided through implementation of the procedures set forth in the LANL *Threatened and Endangered Species Habitat Management Plan* (LANL 2000b) (see Appendix G.3).

Radioactive Liquid Waste Treatment Facility

There would be no anticipated impacts to terrestrial resources or wetlands from implementing any of the alternatives for the RLWTF, since it is located within a highly developed industrial area of TA-50. However, the industrial area where the RLWTF is located is within developed core and buffer zone habitat of the Sandia-Mortandad Canyon Mexican spotted owl Area of Environmental Interest. Under all alternatives, direct impacts to the spotted owl are unlikely; however, demolition and construction activities could result in indirect impacts from excess noise and light. Such impacts would be avoided through implementation of the procedures set forth in the LANL *Threatened and Endangered Species Habitat Management Plan* (LANL 2000b). If the option to construct the evaporation ponds is implemented 4 acres (1.6 hectares) of primarily open field habitat would be disturbed with the resultant loss and displacement of wildlife. This area is within the buffer and core zones of the Sandia and Mortandad Canyon Mexican spotted owl Area of Environmental Interest and a small portion of these zones would be lost. This would likely reduce the extent of perennial and intermittent stream reaches, and associated wetlands and riparian habitat, thereby reducing the abundance and diversity of prey species. Noise and light associated with the project should not adversely affect the owl. Consultation with the U.S. Fish and Wildlife Service would be undertaken, and reasonable and prudent alternatives would be determined for implementation.

Solid Radioactive and Chemical Waste Facilities

Under both options proposed for the Waste Management Facilities Transition activities (capping and removal) within TA-54, including new construction and removal of the white-colored domes, the activities would occur within developed areas. Thus, there would be little to no impact on ecological resources. While the TA does not fall within Areas of Environmental Interest for the Mexican spotted owl or bald eagle, it does include a portion of the southwestern willow flycatcher Area of Environmental Interest along its southern boundary. Use of best management practices would be expected to control storm water runoff associated with work in MDA G and MDA L that could result in indirect downstream impacts to the species.

The proposed Transuranic Waste Processing Facility could be located within either TA-50 or TA-63, and would disturb about 2 to 4 acres (0.8 to 1.6 hectares) of land. This would have minimal impact on ecological resources, although some trees would likely have to be removed if the TA-50 site were selected. Impacts to wetlands and aquatic resources from this project would not be expected. While direct impacts to the Mexican spotted owl from construction of the Transuranic Waste Processing Facility would not be expected, construction has the potential to disturb the species due to excess noise or light. Such impacts would be prevented through implementation of measures set forth in the LANL *Threatened and Endangered Species Habitat Management Plan* (LANL 2000b).

Pajarito Site

The DD&D of facilities at TA-18 would be of little impact on wildlife habitat during the processes since the facilities are located within areas that are developed and fenced. Animals could be intermittently disturbed by construction activity and noise during the demolition period. Implementation of best management practices during demolition would prevent potentially sediment laden runoff from reaching the wetland located at the eastern end of TA-18. Ultimately, previously disturbed areas would be restored using native species. This would have a beneficial effect on area wildlife.

The DD&D of buildings and structures at TA-18 would not directly impact the Mexican spotted owl, since all activities would take place within developed areas. Indirect impacts would be prevented through implementation of the procedures set forth in the LANL *Threatened and Endangered Species Habitat Management Plan* (LANL 2000b). As noted above, TA-18 would undergo restoration following DD&D. The restoration of canyon habitat could benefit the Mexican spotted owl by creating additional habitat within both the core and buffer zone of the Threemile Canyon Area of Environmental Interest in the long term (see Appendix H).

Science Complex

Construction of the Science Complex would involve the clearing and grading of approximately 5 acres (2 hectares) of ponderosa pine forest under the Northwest TA-62 and Research Park Site options. This would result in the loss and displacement of associated wildlife. Indirect impacts from construction, such as noise or human disturbance, could also impact wildlife. Construction of the new buildings and parking structure would not impact wetlands since none are located in or near the construction zone under either option. Operation of the Science Complex would have minimal impact on terrestrial resources since wildlife residing in the area has already adapted to levels of noise and human activity associated with development in the general area. Impacts to ecological resources would be minimal under the South TA-3 option since the area is already partially developed and is within the more developed part of TA-3.

Although limited core and buffer habitat within the Los Alamos Canyon Mexican spotted owl Area of Environmental Interest would be affected under both the Northwest TA-62 or Research Park Site options, direct impacts on the Mexican spotted owl are unlikely. However, indirect impacts from excess noise and light are possible. If owls were determined to be present prior to construction restrictions would be implemented to ensure that noise and lighting limits were met.

Further, Section 7 consultation with the U.S. Fish and Wildlife Service would be conducted. Impacts to the Mexican spotted owl would not be expected under the South TA-3 option.

Warehouse and Truck Inspection Station

The proposed project would result in the clearing and grading of approximately 4 acres (1.6 hectares) of ponderosa pine forest and piñon-juniper woodland. This would result in the loss and displacement of associated wildlife. Indirect impacts from construction, such as noise or human disturbance, could also impact wildlife. Operation of the proposed Remote Warehouse and Truck Inspection Station would not be likely to pose significant adverse effects to area wildlife. Impacts to the bald eagle, southwestern willow flycatcher, and Mexican spotted owl would not be expected since the site is more than a mile (1.6 kilometers) from the nearest Area of Environmental Interest.

5.6 Human Health

5.6.1 Radiological Impacts on the Public

People can be exposed to radiation through a variety of ways: inhalation, ingestion, injection, and from penetrating radiation. Airborne radioactive particles can be inhaled. Radioactive particles can be ingested if they are on the surface of food, or if the food was produced in areas contaminated with radioactive material that can be taken up by plants and animals. The body can also receive direct exposure to radiation from radionuclides in air emissions or from being in the vicinity of radioactive materials that have been deposited on the ground. Additionally, radiation can enter the body through skin breaks. Estimates were made of the amount of radioactive materials to which the public could be exposed as a result of LANL radioactive air emissions (see Section 5.4.2). Using these estimates, the radiation doses from LANL operations to the public and at certain receptor locations were calculated (details can be found in Appendix C).

The total annual radiation dose received by an individual is a combination of potential dose from LANL operations in addition to several other sources of radiation: naturally occurring background radiation, medical radiation, and radiation from other nuclear activities. A challenge in measuring dose is that no person has the same actual exposure rate as any other. Because of this, health impacts analyses often evaluate the upper bound for individual exposure, which is expressed as the potential dose to the hypothetical MEI. For this analysis, the MEI is a hypothetical person who is assumed to remain in place outdoors without shelter and without taking any protective action for the entire period of exposure. In reality, no one would receive a dose approaching that of an MEI, but the concept is useful as an expression of the upper bound of any possible dose to an individual.

Historical data and capabilities were reviewed for the *1999 SWEIS* to help determine which LANL facilities would be analyzed as Key Facilities. For this new SWEIS, changes to those capabilities and past emissions determined which facilities would remain as Key Facilities. **Table 5–15** lists those Key Facilities used in the human health analysis of this SWEIS.

Table 5–15 List of Facilities Modeled for Radionuclide Air Emissions from Los Alamos National Laboratory

Key Facility Name	*Technical Area/Building*
Chemistry and Metallurgy Research Building	TA-3-29
Sigma Complex	TA-3-66
Machine Shops	TA-3-102
High Explosives Processing Facilities	TA-11
High Explosives Testing (Firing Sites)	TA-15/36
Tritium Facility [a]	TA-16
Pajarito Site	TA-18
Radiochemistry Facility	TA-48
Los Alamos Neutron Science Center	TA-53
Solid Radioactive and Chemical Waste Facilities [b]	TA-54
Plutonium Facility Complex	TA-55
Tritium Facility	Non-Key Facilities (TA-21)

TA = technical area.

[a] This facility includes the Weapons Engineering Tritium Facility (TA-16). The Tritium Science Fabrication Facility and Tritium System Test Assembly at TA-21 continue to have emissions while awaiting DD&D, and are included under the non-Key Facilities.

[b] Includes MDA G and the Decontamination and Volume Reduction System.

Some facilities that have historically low emission rates are unmonitored. These unmonitored point sources receive periodic confirmatory measurements by LANL personnel to verify that emissions remain low. The *1999 SWEIS* analyzed air emissions data from TA-50-1 (RLWTF). This analysis confirmed that air emissions were "insignificant relative to other sources at LANL" (LANL 1997b) and the dose to the public from those emissions was not analyzed. For this new SWEIS, air emissions data from the RLWTF were again reviewed for the period 1999–2004. This review of actual radiological air emissions shows that since 2002 the trend is decreasing with a low of 7.9×10^{-8} curies per year (in 2004). The six-year average for TA-50 emissions during that period (1.1×10^{-7} curies) is far less than emissions from LANSCE (2,700 curies), the major contributor to the public dose. It is anticipated that air emissions data would remain the same for the purposes of analyses within this new SWEIS, and therefore, would result in insignificant health-related impacts to the public relative to other sources.

For the purpose of this new SWEIS, the Clean Air Act Assessment Package – 1988 (CAP-88) software was used to calculate these doses. CAP-88 is an approved computer model for calculating the effective dose equivalent to members of the public, as required by emission monitoring and compliance procedures for DOE facilities [40 CFR 61.93 (a)]. CAP-88 uses modified Gaussian plume equations to estimate the average dispersion of radionuclides released to the air from up to six emitting sources. The program computes radionuclide concentrations in air, rates of deposition on ground surfaces, concentrations in food, and intake rates to people from ingestion of food produced in the assessment area.

In this SWEIS, an estimation of the dose to the facility-specific MEI was calculated for each modeled facility. The location of each facility-specific MEI is where the dose from that facility's emissions to a member of the public would be greatest. The location of the facility-specific MEI is based on wind direction and meteorological data for that facility. **Table 5–16** shows the

distance and direction from each facility to its facility-specific MEI. The doses were then calculated at this facility-specific MEI location from all modeled facilities; thus, the facility-specific MEI represents the estimated dose to an individual from the specific facility and all other modeled facilities. The LANL site-wide MEI is the single highest facility-specific MEI; therefore any other facility-specific MEI dose would be less than the LANL site-wide MEI for that alternative.

Table 5–16 Distance and Direction from Key Facilities to the Facility-Specific Maximally Exposed Individual

Key Facility	*MEI Distance Feet (meters)*	*MEI Direction*
Chemistry and Metallurgy Research Building (TA-3–29)	3,575 (1,090)	N
Sigma Complex (TA-3–66)	3,560 (1,085)	N
Machine Shops (TA-3–102)	3,380 (1,030)	N
High Explosives Processing (TA-11)	4,300 (1,311)	S
High Explosives Testing (TA-15/36)	7,415 (2,260)	NE
Tritium Facility (TA-16)	2,885 (879)	SSE
Pajarito Site (TA-18)	2,820 (860)	NE
Radiochemistry Facility (TA-48)	2,920 (890)	NNE
Los Alamos Neutron Science Center (TA-53)	2,625 (800)	NNE
Solid Radioactive and Chemical Waste Facilities (TA-54)	1,195 (364)	NE
Plutonium Facility Complex (TA-55)	3,690 (1,125)	N
Non-Key Facilities (TA-21)	1,050 (320)	N

MEI = maximally exposed individual, TA = technical area.

Population dose estimates were made for the entire population within a 50-mile (80-kilometer) radius of LANL by summing the estimated doses to all people within that radius. The population dose from each facility was modeled independently for each alternative. The total from all facilities for one alternative represents the projected population dose from implementing that alternative.

In addition to dose, estimates of risk to the public and the MEI were calculated. Scientists and decisionmakers quantify relationships among risks by using mathematical probabilities. In this SWEIS, risks are defined in terms of the added number of latent cancer deaths (excess LCFs due to the estimated dose) from LANL operations. The number of additional LCFs is calculated as the product of the dose in units of person-rem and the risk factor (0.0006 LCF per person-rem). These estimates are intended to provide a conservative measure of the potential impacts to be used in the decisionmaking process, and do not necessarily portray an accurate representation of actual anticipated fatalities.

Tables 5–17 and **5–18** summarize the projected dose to the public from normal operations for each alternative for both a MEI near LANL property and the general population within 50 miles (80 kilometers) of LANL. The potential impact from the shut down of operations at LANSCE under the Reduced Operations Alternative would result in a major decrease in dose to the general public and to the MEI. Under all of the alternatives, the MEI would receive a dose that is smaller than the exposure limits set by the DOE and EPA.

Table 5–17 Summary of Projected Doses to the Maximally Exposed Individual from Normal Operations at LANL (millirem per year)

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site-Wide			
Dose from MDA remediation only to LANL Site-Wide MEI	Not applicable	Not applicable	less than 0.42 [b]
Key Facilities [a], Includes contributions from:			
CMR Building	0.011	0.016	0.011
Sigma Complex	0.0041	0.0060	0.0041
Machine Shops	0.00032	0.00045	0.00032
High Explosives Processing	1.3×10^{-6}	1.8×10^{-6}	1.3×10^{-6}
High Explosives Testing	0.25	0.72	0.25
Tritium Facility	0.0036	0.0045	0.0036
Pajarito Site	0.0070	0.0080 [c]	0.0070 [c]
Radiochemistry Facility	0.00029	0.00050	0.00029
LANSCE [d]	7.5	0	7.5
Solid Radioactive and Chemical Waste Facilities	0.0012	0.0012	0.0012 [e]
Plutonium Facility Complex	0.012	0.024	0.012
Non-Key Facility (TA-21)	0.012	0.0071	0.012 [f]
Total LANL Site-Wide MEI Dose	7.8	0.79	Less than 8.2 [b]

MDA = material disposal area, MEI = maximally exposed individual, CMR = Chemistry and Metallurgy Research, LANSCE = Los Alamos Neutron Science Center, TA = technical area.

[a] Under the No Action and the Expanded Operations Alternatives, the LANL site-wide MEI would be located near LANSCE. Under the Reduced Operations Alternative, the LANL site-wide MEI would be located near the High Explosives Testing (Firing Sites) at TA-36.

[b] This dose could be smaller depending on which MDA is being remediated, whether the MDA is being capped or removed, the number of MDAs being remediated at one time, and whether exhumation occurs under a containment structure (see Appendix I).

[c] Dose would be zero following shutdown of Pajarito Site (TA-18) starting in 2009.

[d] The maximum dose to the MEI as a result of emissions from LANSCE would be limited to 7.5 millirem per year using administrative controls.

[e] This dose could increase to 0.0017 millirem per year if the Decontamination and Volume Reduction System, the new Transuranic Waste Consolidation Facility, and remote-handled transuranic waste retrieval and processing activities operated simultaneously (estimated to occur from 2012 through 2015).

[f] Dose would be zero following decontamination, decommissioning, and demolition of TA-21 starting in 2009.

Table 5–18 Summary of Projected Doses to the General Public Within 50 Miles (80 Kilometers) of Los Alamos National Laboratory from Normal Operations (person-rem per year)

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site-Wide			
Dose from MDA remediation	Not applicable	Not applicable	Less than 6.2 [a]
Key Facilities, Includes contributions from:			
CMR Building	0.43	0.43	0.43
Sigma Complex	0.16	0.16	0.16
Machine Shops	0.01	0.01	0.01
High Explosives Processing	0.00005	0.00004	0.00005
High Explosives Testing	6.4	5.15	6.4
Tritium Facility	0.09	0.09	0.09
Pajarito Site	0.23	0.23 [b]	0.23 [b]
Radiochemistry Facility	0.01	0.01	0.01
LANSCE	22	0	22
Solid Radioactive and Chemical Waste Facilities	0.04	0.04	0.04 [c]
Plutonium Facility Complex	0.19	0.19	0.20
Non-Key Facility (TA-21)	0.09	0.09	0.09 [d]
Total Dose to General Population	30	6.4	Less than 36.2 [a]

MDA = material disposal area, CMR = Chemistry and Metallurgy Research, LANSCE = Los Alamos Neutron Science Center, TA = technical area.

[a] This dose could be smaller depending on which MDAs are being remediated, whether the MDA are being capped or removed, the number of MDAs being remediated at one time, and whether exhumation occurs under a containment structure (see Appendix I).

[b] Dose would be zero following shutdown of Pajarito Site (TA-18) starting in 2009.

[c] This dose could increase to 0.06 person-rem per year if the Decontamination and Volume Reduction System, the new Transuranic Waste Consolidation Facility, and remote-handled transuranic waste retrieval and processing activities operated simultaneously (estimated to occur from 2012 through 2015).

[d] Dose would be zero following decontamination, decommissioning, and demolition of TA-21 starting in 2009.

5.6.1.1 No Action Alternative

The annual doses to the general public and a MEI under the No Action Alternative are generally projected to remain at levels similar to those projected in the *1999 SWEIS* Expanded Operations Alternative. The doses for the MEI and population are dominated by the projected emissions from operations at LANSCE. The projected doses also reflect the expected relocation of certain tritium capabilities from the Chemistry and Metallurgy Research Building back to the Plutonium Facility Complex as well as the change in operating levels as the Tritium Facility (TA-21) begins its DD&D.

Los Alamos National Laboratory Site-Wide Impacts

The projected annual collective dose to the population living within a 50-mile (80-kilometer) radius of LANL could be as high as 30 person-rem for the No Action Alternative. Nearly all of this dose (greater than 99 percent) is from operations of the Key Facilities and the remaining contribution is from non-key facility operations. Overall, the projected dose of 30 person-rem

would result in no additional fatalities in the affected population (0.018 LCFs). The dose to the general public and a MEI under the No Action Alternative are presented in **Table 5–19**. To put the doses into perspective, comparisons with natural background radiation levels are included in the table.

Table 5–19 Annual Radiological Impacts on the Public from Los Alamos National Laboratory Operations under the No Action Alternative

	Population within 50 Miles (80 kilometers) [a]	*Maximally Exposed Individual*
Dose	30 person-rem	7.8 millirem (LANSCE MEI) [b]
Latent cancer fatality risk [c]	0.018	4.7×10^{-6}
Regulatory dose limit [d]	Not applicable	10 millirem
Dose as a percent of regulatory limit	Not applicable	78
Dose from background radiation [e]	144,000 person-rem	425 millirem
Dose as a percent of background dose	0.02	1.8

LANSCE = Los Alamos Neutron Science Center, MEI = maximally exposed individual.

[a] The population estimated to be living within 50 miles (80 kilometers) of each Key Facility is unique for each facility. The year 2000 estimates range from 271,568 to 404,913, depending on the facility used.

[b] As a mitigating measure, operational controls at LANSCE would limit the MEI dose to 7.5 millirem per year.

[c] Based on a risk estimate of 0.0006 LCF per person-rem.

[d] 40 CFR 61 establishes an annual limit of 10 millirem via the air pathway to any member of the public from DOE operations. There is no standard for a population dose.

[e] The annual individual dose from natural background radiation at LANL ranges from 350 to 500 millirem (see Appendix C).

Under this alternative, the LANL site-wide MEI would be located approximately 2,625 feet (800 meters) north-northeast of LANSCE. This is the location where the dose resulting from emissions from all Key Facilities would be the highest. The annual dose to the MEI under this Alternative could be up to 7.8 millirem. This projected dose corresponds to an increased risk of developing a fatal cancer for the MEI from LANL operations under the No Action Alternative of about 1 chance in 213,000 (4.7×10^{-6}) per year.

Special Receptors

In addition to the potential for impacts to the public from the air exposure pathway, the risk to individuals from ingestion of water, foodstuffs, and soils is analyzed in Appendix C. These three individual scenarios include a Los Alamos County resident whose entire diet consists of locally-produced foodstuffs, an outdoor recreational enthusiast, and a Special Pathways receptor who relies heavily on fish and wildlife for subsistence. Using the worst-case consumption rates, **Table 5–20** presents the projected doses to these individuals and the associated risk of developing a fatal cancer.

Table 5–20 Annual Ingestion Pathway Dose for Worst-Case Consumption Rates by Special Receptors

	Dose (millirem)	*Cancer Fatality Risk* [a]
Offsite Resident	7.2	4.3×10^{-6}
Recreational User	9.1	5.5×10^{-6}
Special Pathways Receptor	10.7	6.4×10^{-6}

[a] Based on a risk estimate of 0.0006 LCF per person-rem.

The associated LCF risks as a result of the doses shown in Table 5–20 would be about 1 in 230,000 for the Offsite Resident, 1 in 180,000 for the Recreational User, and 1 in 156,000 for the Special Pathways receptor per year. The doses from ingestion are almost entirely due to naturally occurring radioactivity in the environment and contamination in water and soils from worldwide fallout and past LANL operations. The contribution to ingestion pathway doses from current and projected future LANL operations tends to be extremely small by comparison, due largely to the more stringent effluent control and waste management practices now in use. Accordingly, these ingestion pathway dose and risk values are expected to remain essentially unchanged for some time into the future and will apply to all three alternatives.

Technical Area Impacts

No measurable doses to the population or the site-wide MEI are expected to result from TA Impacts under the No Action Alternative outside those associated with Key Facilities operations (discussed below).

Los Alamos Neutron Science Center

Nearly all of the calculated MEI dose (96 percent) is attributable to gaseous mixed activation products from operations at LANSCE. Because of the close proximity of the LANSCE facility to the LANL site boundary, gaseous mixed activation product emissions remain the greatest source of offsite dose from the airborne pathway. As a mitigating measure, operational controls at LANSCE limit the amount of radiological air emissions. These controls would limit the maximum dose to the LANL site-wide MEI from air emissions at LANSCE to 7.5 millirem. (The remainder of the dose to the LANL site-wide MEI as a result of LANL operations at all other Key Facilities [0.3 millirem per year] is small when compared to that from operations at LANSCE.)

5.6.1.2 Reduced Operations Alternative

Under the Reduced Operations Alternative, the major decrease in doses to the public compared to the No Action Alternative would be due to the lack of radiological air emissions resulting from the potential cessation of LANSCE operations. Additional lower doses than those under the No Action Alternative would be expected from the reduction of operations in terms of both High Explosives Processing and Testing. In 2009 the cessation of operations at the Pajarito Site (TA-18) would result in a further reduction in doses to the public.

Los Alamos National Laboratory Site-Wide Impacts

The projected annual collective dose to the population living within a 50-mile (80-kilometer) radius of LANL, as shown in **Table 5–21,** could be as high as 6.4 person-rem for the Reduced Operations Alternative. Nearly all of this dose (greater than 98 percent) is from operations of the Key Facilities and the remaining contribution is from non-key facility operations. Overall, the projected dose of 6.4 person-rem would result in no additional fatalities in the affected population (0.0038 LCFs).

Table 5–21 Annual Radiological Impacts on the Public from Los Alamos National Laboratory Operations under the Reduced Operations Alternative

	Population within 50 Miles (80 kilometers) [a]	*Maximally Exposed Individual*
Dose [b]	6.4 person-rem	0.79 millirem (TA-36 MEI)
Latent cancer fatality risk [c]	0.0038	4.7×10^{-7}
Regulatory dose limit [d]	Not applicable	10 millirem
Dose as a percent of regulatory limit	Not applicable	7.9
Dose from background radiation [e]	144,000 person-rem	425 millirem
Dose as a percent of background dose	0.004	0.19

rem = roentgen equivalent man, TA = technical area, MEI = maximally exposed individual, MDA = material disposal area.

[a] The population estimated to be living within 50 miles (80 kilometers) of each Key Facility is unique for each facility. The year 2000 estimates range from 271,568 to 404,913, depending on the facility used.

[b] The shutdown of TA-18 in 2009 would result in a decrease in population dose of 0.23 person-rem and a negligible decrease in MEI dose.

[c] Based on a risk estimate of 0.0006 LCF per person-rem.

[d] 40 CFR 61 establishes an annual limit of 10 millirem via the air pathway to any member of the public from DOE operations. There is no standard for a population dose.

[e] The annual individual dose from natural background radiation at LANL ranges from 350 to 500 millirem (see Appendix C).

The LANL site-wide MEI under this alternative would be located approximately 7,415 feet (2,260 meters) northeast of the High Explosives Testing sites at TA-36. This is the location where the dose resulting from emissions from all Key Facilities would be the highest. The estimated dose to this MEI would be 0.79 millirem per year for the foreseeable future. This projected dose corresponds to an increased risk of developing a latent fatal cancer for the MEI from LANL operations under the Reduced Operations Alternative of about 1 chance in 2.1 million (4.7×10^{-7}) per year.

Special Receptors

The risk to the public from ingestion of foodstuffs and water under the Reduced Operations Alternative does not differ from that described in the No Action Alternative as most of the risk is attributable to the existing levels of contamination, not future operations at LANL.

Technical Area Impacts

No measurable doses to the population or the site-wide MEI are expected to result from TA Impacts under the Reduced Operations Alternative outside those associated with Key Facilities operations (discussed below).

Key Facility Impacts

Los Alamos Neutron Science Center

Under this alternative, operations at LANSCE would not be active and high explosives processing and testing would be reduced by 20 percent resulting in a 79 percent reduction in the total projected dose to the population as compared to the dose for the No Action Alternative.

High Explosives Testing

The long-lived uranium isotope emissions from the reduced level of activities at the High Explosives Testing at TA-15 and TA-36 would produce the majority of the population dose (80 percent). Because the location of the MEI under the Reduced Operations Alternative would change from the location of the MEI associated with the No Action Alternative, the dose contributions from each Key Facility to the new MEI location would be different. For instance, the dose to the MEI from operations at the High Explosives Testing sites would be projected to be 0.72 millirem per year under this alternative, compared to a dose of 0.25 millirem from high explosives testing under the No Action Alternative even though there is a 20 percent reduction in high explosives testing under the Reduced Operations Alternative. In fact, more than 90 percent of the dose to the MEI under the Reduced Operations Alternative would be from emissions of uranium isotopes produced at the High Explosives Testing sites.

Pajarito Site

Starting in 2009, a decrease in dose of 0.23 person-rem per year would result from the cessation of operations at the Pajarito Site (TA-18).

5.6.1.3 Expanded Operations Alternative

Under the Expanded Operations Alternative, there would be new and expanded capabilities, construction projects, and some reduced activities. Operations as a result of LANSCE refurbishment could increase air emissions, including radiological emissions and consequential dose, due to enhanced operational availability of the accelerator facilities. There would also be an increase in pit production capability within the Plutonium Facility Complex (TA-55) of up to 50 pits per year under single-shift operations (80 pits per year using multiple shifts) resulting in additional radiological air emissions. Under this alternative there could be an additional temporary or one-time dose to the public from the cleanup of the MDAs, lasting until the MDA exhumation is completed. Implementation of this alternative would also result in smaller doses due to both the completion of the DD&D of buildings at TA-21 and the cessation of SHEBA operations at TA-18.

Los Alamos National Laboratory Site-Wide Impacts

The projected annual collective dose to the population living within a 50-mile (80-kilometer) radius of LANL, as shown in **Table 5–22,** could be as high as 36 person-rem for the Expanded Operations Alternative; 30 person-rem of that total dose is from operations at the Key Facilities and the remaining 6 person-rem from remediation activities at the various MDAs. Overall, the projected dose of 36 person-rem would result in no additional fatalities in the affected population (0.022 LCFs).

Under this alternative, the LANL site-wide MEI would be located approximately 2,625 feet (800 meters) north-northeast of LANSCE. This is the location where the dose resulting from emissions from all Key Facilities would be the highest. Including the additional dose from remediation activities at the MDAs under this Alternative could bring the MEI dose to about 8.2 millirem. This projected dose corresponds to an increased risk of developing a latent fatal

cancer for the MEI from LANL operations under the Expanded Operations Alternative of about 1 chance in 203,000 (4.9×10^{-6}) per year.

Table 5–22 Annual Radiological Impacts on the Public from Los Alamos National Laboratory Operations under the Expanded Operations Alternative

	Population within 50 Miles (80 kilometers) [a]	***Maximally Exposed Individual***
Dose [b]	36 person-rem	8.2 millirem (LANSCE MEI) [c]
Latent cancer fatality risk [d]	0.022	4.9×10^{-6}
Regulatory dose limit [e]	Not applicable	10 millirem
Dose as a percent of regulatory limit	Not applicable	82
Dose from background radiation [f]	144,000 person-rem	425 millirem
Dose as a percent of background dose	0.025	1.9

LANSCE = Los Alamos Neutron Science Center, MEI = maximally exposed individual, MDA = material disposal area

[a] The population estimated to be living within 50 miles (80 kilometers) of each Key Facility is unique for each facility. The year 2000 estimates range from 271,568 to 404,913, depending on the facility used.

[b] These reflect the additional doses to the public from remediation of the larger MDAs and the simultaneous operation of the Decontamination and Volume Reduction System, the new Transuranic Waste Consolidation Facility, and remote-handled transuranic waste retrieval and processing activities. The shut down of TA-18 and TA-21 in 2009 would result in a decrease in population dose of 0.32 person-rem and a negligible decrease in MEI dose.

[c] As a mitigating measure, operational controls at LANSCE would limit the MEI dose to 7.5 millirem per year. Population and MEI dose include 6.2 person-rem and 0.42 millirem respectively, attributable to MDA remediation.

[d] Based on a risk estimate of 0.0006 LCF per person-rem.

[e] 40 CFR 61 establishes an annual limit of 10 millirem via the air pathway to any member of the public from DOE operations. There is no standard for a population dose.

[f] The annual individual dose from natural background radiation at LANL ranges from 350 to 500 millirem.

The varying effects of radiological air emissions from the major MDA remediation, canyon cleanups and other Consent Order actions could range from small long-term to temporary short-term doses to the public under the Expanded Operations Alternative. Under the MDA Capping Option, although the waste would remain in place, the long-term doses to the public would be reduced. The potential for radionuclides to be dispersed into the air would be reduced by the improved covers, resulting in reduced doses. The MDA Removal Option would result in lower long term risks to members of the public as the bulk of the contamination would be removed from the site. But in the short term, the release of radionuclides into the air during removal could result in higher radiological doses to the public. If that removal were to take place under a containment structure, the releases of radiological air emissions would be filtered before exiting the structure, resulting in lower short-term doses to the public.

Under the MDA Removal Option, varying radiological air emissions would be released depending on the inventory of radionuclides at the MDA being remediated and whether the removal was performed under a containment structure. These removal activities would have a finite time period associated with their completion, lasting from a few months to several years depending upon the MDA. For that specified amount of time, there would be a dose to the public resulting from emissions released during the removal of the MDA. There are several large MDAs to be remediated. The total estimated dose to the public within 50 miles (80 kilometers) of operations at LANL under this Alternative includes a conservative dose estimate (6.2 person-rem per year) assuming all MDAs were being exhumed at one time.

The same factors, the inventory of radionuclides present in a given MDA and whether or not there is a containment structure being used, would have an affect on the dose to the MEI. In addition, the location of the MDA being remediated could have an affect on how much dose an MEI would receive. The impacts of the remediation of the MDAs on the LANL site-wide MEI were analyzed in Appendix I. Removal activities at each MDA could result in a contribution to the dose received by the LANL site-wide MEI under the Expanded Operations Alternative, located northeast of LANSCE near East Gate. Assuming *all* the large MDAs were being remediated at the same time, the portion of the estimated dose to the LANL site-wide MEI from MDA removal activities would be no more than 0.42 millirem in any given year.

Special Receptors

The risk to the public from ingestion of foodstuffs and water under the Expanded Operations Alternative does not differ from that described in the No Action Alternative as most of the risk is attributable to the existing levels of contamination, not future operations at LANL.

Technical Area Impacts

No measurable doses to the population or the site-wide MEI are expected to result from TA Impacts under the Expanded Operations Alternative outside those associated with Key Facilities operations (discussed below) or MDA remediation activities (discussed above).

Key Facility Impacts

Under the Expanded Operations Alternative, the impacts to the public from activities at the Key Facilities, including both the increase in some activities and decreases in others, would remain similar to those in the No Action Alternative. The change in location of emissions from the Chemistry and Metallurgy Research Building in TA-3 to near TA-55 would have little effect on doses to the public when compared to the impacts from operations at LANSCE. Similarly, the increase in pit production at the Plutonium Facility Complex (TA-55) would result in a small increase in emissions and the resulting doses to the public would be relatively small when compared to the contribution from activities at LANSCE.

Los Alamos Neutron Science Center

Over 60 percent of the projected population dose (22.3 person-rem per year) would result from radiological air emissions from LANSCE (TA-53). Similar to the No Action Alternative, the majority of the dose to the LANL site-wide MEI under the Expanded Operations Alternative results from gaseous mixed activation products from operations at LANSCE. Because of the close proximity of LANSCE to the LANL site boundary, gaseous mixed activation product emissions remain the greatest source of offsite dose from the airborne pathway.

High Explosives Testing

An additional 18 percent of the dose (6.4 person-rem per year) would be from operations at the High Explosives Testing Sites (TA-15 and TA-36).

Solid Radioactive and Chemical Waste Facilities

Implementation of the Waste Management Facilities Transition Project could result in relatively small additional impacts to the population near LANL. During the 2012 through 2015 time period, there is the potential for the simultaneous operation of the DVRS, the new Transuranic Waste Consolidation Facility, and remote-handled transuranic waste retrieval and processing activities. The resulting impacts to the population from the operations of these systems during this time would be negligible (an additional 0.02 person-rem per year) and are included in Table 5–22. Long-term impacts to the population would be a reduction in dose due to the eventual removal of stored wastes in Area G.

Plutonium Facility Complex

The higher level of activity at the Plutonium Facility Complex associated with increased pit production would also result in a small increase in the dose to the population to 0.20 person-rem per year. The higher level of activity at the Plutonium Facility Complex associated with increased pit production would result in a negligible increase in the dose to the MEI (less than 0.001 millirem).

Pajarito Site and Tritium Facility

Starting in 2009, the estimated population dose would decrease slightly (by 0.32 person-rem per year) as a result of no emissions from activities at Pajarito Site (TA-18) and the Tritium Facility at TA-21. The lack of activity at the Pajarito Site (TA-18) and the Tritium Facility (TA-21) would have a small effect (a decrease of 0.02 millirem per year) on the dose to the MEI when compared to the dose from operations at LANSCE (7.5 millirem per year).

5.6.2 Chemical Impacts on the Public

5.6.2.1 No Action Alternative

Key Facilities

The combined cancer risk due to all carcinogenic pollutants from all technical areas, as analyzed in the *1999 SWEIS*, was dominated by the chloroform emissions expected from the Bioscience Facilities (formerly the Health Research Laboratory) (see **Tables 5–23** and **5–24**). Assuming that 100 percent of the chloroform used was emitted (and assuming no change in other carcinogenic pollutant emissions as compared to those evaluated,) the estimated combined incremental cancer risk at the Los Alamos Medical Center would be slightly above the guideline value of one in one million (1.0×10^{-6}). However, it is known that less than 100 percent of the chloroform used is emitted as a toxic air pollutant (as much as 25 pounds per year [8 liters per year] were disposed of as liquid chemical waste), thus the incremental cancer risk under the No Action Alternative would be less than the guideline value. In addition, recent use of chloroform has been about 30 percent of the use projected in the *1999 SWEIS* for the Expanded Operations Alternative. Based on the information discussed above, toxic air pollutants released under this new SWEIS No Action Alternative are not expected to cause air quality impacts that would affect human health and the environment.

Table 5–23 Estimated Annual Emission Rates of the Carcinogenic Pollutants that Have the Potential to be Released from the Health Research Laboratory of the Technical Area 43 Facilities

Pollutants	*Stack ID*	*Annual Average Emission Rates*	
		Pounds per Year	*Grams per Second*
Acrylamide	Building 247	0.00586	8.44×10^{-8}
	Building 124/126	0.00586	8.44×10^{-8}
	N. Side FH	0.00586	8.44×10^{-8}
	S. Side FH	0.00586	8.44×10^{-8}
Chloroform	Building 247	2.2	0.0000317
	Building 124/126	21.3	0.000307
	N. Side FH	21.3	0.000307
	S. Side FH	21.3	0.000307
Formaldehyde	Building 247	0.173	0.0000025
	Building 124/126	1.68	0.0000241
	N. Side FH	1.68	0.0000241
	S. Side FH	1.68	0.0000241
Methylene Chloride	N. Side FH	0.946	0.0000136
	S. Side FH	0.946	0.0000136
Trichloroethylene	N. Side FH	10.2	0.000147

Source: DOE 1999a.

Table 5–24 Results of the Dispersion Modeling Analysis of the Carcinogenic Pollutants from the Health Research Laboratory at Technical Area 43

Carcinogenic Pollutants	*Estimated Annual Concentration (micrograms per cubic meter)*
Acrylamide	0.0000115
Chloroform	0.0304
Formaldehyde	0.0024
Methylene Chloride	0.00078
Trichloroethylene	0.00334

Source: DOE 1999a.

Public health consequences for the high explosives testing sites from emissions of beryllium, lead, and depleted uranium (DU) (see Table 5−9) were analyzed by calculating hazard indices for lead and DU and calculating the excess LCFs from beryllium. An hazard index equal to or above 1 is considered consequential from a human toxicity standpoint. Beryllium has no established EPA reference dose from which to calculate the hazard index. The worst-case hazard index for lead was less than 0.000015 and for DU was less than 0.000065. The excess LCFs from beryllium were estimated to be 1 in 2,780,000 (3.6×10^{-7}) (DOE 1999a). Use of foam to control emissions from the high explosives testing sites would further reduce these emissions and health effects by about 20 percent (LANL 2006).

Emissions from beryllium sources, currently at the Chemistry and Metallurgy Research Buildings (TA-3) and Plutonium Facility Complex (TA-55) (see Table 5−10), are controlled by HEPA filtration with a removal efficiency of 99.95 percent. The maximum cancer risk of beryllium releases from TA-3 using its unit risk factor is approximately 1 chance in 415 million

(2.41×10^{-9}), which is below the guideline value of 1 chance in a million (1.0×10^{-6}). The maximum combined cancer risk of beryllium releases from TA-55 using its unit risk factor is approximately 1 in 4.3 billion (2.35×10^{-10}), which is also below the guideline value of 1 chance in a million (1.0×10^{-6}) (DOE 1999a).

5.6.2.2 Reduced Operations Alternative

Key Facilities

Public risk as a result of chemical releases under the Reduced Operations Alternative would be approximately the same as those associated with the No Action Alternative. There could a reduction in risks associated high explosives processing and testing activities since these activities would be reduced by 20 percent under this alternative. There would also be minor reductions in risk to the public as a result of shutting down operations at LANSCE and the Pajarito Site (TA-18) under this Alternative.

5.6.2.3 Expanded Operations Alternative

Key Facilities

Public risk as a result of chemical releases under the Expanded Operations Alternative would be approximately the same as those associated with the No Action Alternative with the exception of a small increase (2.5 percent) in high explosives processing that would not be expected to substantially change these risks.

5.6.3 Worker Health

Worker risks associated with continued operations of LANL include radiological (ionizing and nonionizing) risks, chemical exposure risks, and risk of injury during normal operations. The consequences to worker health from implementing the No Action, Reduced Operations, and Expanded Operations Alternatives are given below.

DOE has developed new regulations to require non-nuclear DOE contractors to comply with relevant Occupational Safety and Health Administration safety and health standards. Non-compliance could result in monetary fines. This is the first DOE regulation to provide for the protection of non-nuclear contractor workers. This new rule, 10 CFR 851, goes into effect on February 7, 2007 to allow one year for contractor and site management compliance training (DOE 2006).

5.6.3.1 No Action Alternative

Ionizing Radiation Consequences

Table 5–25, presents the projected worker exposure from normal operations under the No Action Alternative. This projection is higher than the average annual worker dose shown in Section 4.6.2.1 because it includes the dose associated with achieving a production level of 20 pits per year at TA-55 and increased levels of activity associated with additional personnel working in the new Chemistry and Metallurgy Research Building Replacement. This collective

worker dose would remain representative of the dose seen by the LANL workforce for the foreseeable future for the No Action Alternative.

Table 5–25 Projected Worker Exposure to Radiation under the No Action Alternative

Collective worker dose (person-rem per year)	281
Number of workers with measurable dose	1,933
Excess LCF risk per year among worker population	0.17 [a]
Average individual worker measurable dose (millirem)	145
Excess LCF risk per year for average individual worker	0.000087 [a]
DOE limit on annual worker radiation exposure (millirem)	5,000
LANL average individual worker dose as a percentage of DOE limit (percent)	2.9

LCF = latent cancer fatality.
[a] Based on a risk estimate of 0.0006 LCF per person-rem (see Appendix C).

Worker exposures to radiation and radioactive materials in radiological control areas would be controlled under established procedures that require doses to be kept as low as reasonably achievable (ALARA). Any potential hazards would be evaluated as part of the radiation worker and occupational safety programs at LANL. Nonroutine construction activities may require special work permits with worker protection measures given for specific locations and activities.

DOE limits set the standard for worker exposure at 5,000 millirem per year whole body dose equivalent. DOE, in 10 CFR 835, requires that the ALARA process be applied to reduce worker exposure to ionizing radiation. DOE has set an administrative control level of 2,000 millirem per year for an individual worker exposure (DOE 1999e). This level can be intentionally exceeded only with higher level management approvals.

Under the No Action Alternative, the average individual worker dose of 145 millirem per year represents an increased risk of developing a latent fatal cancer of approximately 1 chance in 11,500 (8.7×10^{-5}) per year of operations. In addition to the 1,933 workers expected to receive a measurable dose, under the No Action Alternative, there would be over 11,000 LANL workers, or approximately 85 percent of the workforce, who would not likely receive any measurable dose during a year of normal operations.

Nonionizing Radiation Consequences

Under the No Action Alternative, negligible effects on LANL worker health from normal operations of nonionizing radiation sources, infrared radiation from instrumentation and welding, lasers, magnetic and electromagnetic fields, and microwaves would likely continue.

Biological Agent Exposure Consequences

Under the No Action Alternative, there would be negligible effects on LANL worker health from normal operations of the existing Biosafety Level 1 and 2 facilities. As explained in Appendix C, workers are protected by a combination of microbiological safety practices, safety equipment acting as primary barriers, and facilities that provide secondary barriers to preclude contamination or infection by biological agents.

Chemical Exposure Consequences

Occasional reportable, but minor, chemical exposures could occur at the rate of one to three incidents annually due to airborne asbestos, lead paint particles, crystalline silica, fuming perchloric acid, hydrofluoric acid, or skin contact with acids or alkalis.

Operation of the Beryllium Technology Center in the Sigma Complex presents the potential risk of worker exposure to beryllium. Other uses of beryllium at LANL include metals applications which present little risk. The annual worker risk associated with high explosives testing applications of beryllium at LANL, evaluated as a carcinogen in the *1999 SWEIS*, was estimated to be less than 1 chance in 2.7 million (3.6×10^{-7}). This estimate is still valid under the No Action Alternative of this SWEIS.

Occupational Injuries and Illness

The occupational injury and illness rates under the No Action Alternative are projected to follow the patterns observed from 1999 through 2004 reported in Section 4.6.2.1. Using LANL's average rates during this period, workers would have 2.33 recordable cases and 1.22 cases where days were missed, or activities were restricted or transferred as a result of an occupational injury or illness for every 200,000 hours worked. These rates are well below industry averages which in 2004 were 4.8 recordable cases and 2.5 cases where days were missed as a result of an occupational injury or illness (BLS 2005). Assuming that LANL's employment levels remain at current levels, as discussed in Section 5.8.1.1, the total recordable cases in terms of occupational injury and illness would be approximately 310 per year and cases that resulted in days away, restricted or transferred would be approximately 162. No fatalities would be expected under this alternative.

5.6.3.2 Reduced Operations Alternative

Ionizing Radiation Consequences

As shown in **Table 5–26**, under the Reduced Operations Alternative, involved workers would be exposed to lower doses on a cumulative basis from normal operations at LANL than under the No Action Alternative due to the potential shut down of LANSCE operations and the cessation of operations at TA-18.

Table 5–26 Projected Worker Exposure to Radiation under the Reduced Operations Alternative

Collective worker dose (person-rem per year)	258
Number of workers with measurable dose	1,574
Excess LCF risk per year among worker population	0.15 [a]
Average individual worker measurable dose (millirem)	164
Excess LCF risk per year for average individual worker	0.000098 [a]
DOE limit on annual worker radiation exposure (millirem)	5,000
LANL average individual worker dose as a percentage of DOE limit (percent)	3.3

LCF = latent cancer fatality.
[a] Based on a risk estimate of 0.0006 LCFs per person-rem (see Appendix C).

The average dose received by workers is projected to increase slightly from 145 millirem per year to 164 millirem per year under the Reduced Operations Alternative as compared to the No Action Alternative. This is due to a decrease in the number of workers who received less than the average dose under this Alternative. The average individual worker dose of 164 millirem per year represents an increased risk of developing a latent fatal cancer of approximately 1 chance in 10,500 (9.5×10^{-5}) per year of operations. Similar to the No Action Alternative, in addition to the 1,574 workers expected to receive a measurable dose there would continue to be over 11,000 LANL workers, or over 85 percent of the workforce, who would not receive any measurable dose during a year of normal operations, under the Reduced Operations Alternative.

Nonionizing Radiation Consequences

Under the Reduced Operations Alternative, negligible effects on LANL worker health from nonionizing radiation sources, infrared radiation from instrumentation and welding, lasers, magnetic and electromagnetic fields, and microwaves would likely continue.

Biological Agent Exposure Consequences

Under the Reduced Operations Alternative, effects on LANL worker health from normal operations would not be substantially different than those under the No Action Alternative.

Chemical Exposure Consequences

Under the Reduced Operations Alternative, chemical exposure consequences to workers would likely be small and not substantially different than those under the No Action Alternative.

Occupational Injuries and Illness

Under the Reduced Operations Alternative, the number of occupational injuries and illnesses would likely be lower than those observed under the No Action Alternative as a result of a smaller projected workforce as discussed in Section 5.8.1.2. Using LANL's average rates, the total recordable cases in terms of occupational injury and illness would be approximately 297 per year and cases that resulted in days away, restricted or transferred would be approximately 156 compared to 310 and 162 under the No Action Alternative. No fatalities would be expected under this alternative.

5.6.3.3 Expanded Operations Alternative

Ionizing Radiation Consequences

As shown in **Table 5–27**, the expansion of certain radiologically intensive operations at LANL would increase cumulative worker dose and the annual average worker exposure under the Expanded Operations Alternative. The operations expected to expand under this Alternative include the manufacturing of pits, the remediation of a number of large MDAs, and DD&D of a number of TAs. In the long run, the DD&D and closure of many facilities such as those associated with the MDAs at LANL and older waste management facilities in TA-54, Area G should reduce workers' annual radiation exposures.

The largest factors affecting worker dose under this Alternative are the increase in pit production at TA-55 from 20 plutonium pits per year to 50 pits per year under single-shift operations (80 pits per year using multiple shifts) and the remediation of the MDAs. The contribution to the collective worker dose from production of 20 pits per year is 90 person-rem per year for the No Action Alternative compared to 220 person-rem from the production of up to 80 pits per year. Remediation of the MDAs under this Alternative is also expected to add to the site-wide collective worker dose. If the MDA Removal Option were pursued, it would add, on average, 113 person-rem per year to the site-wide collective worker dose. If the MDA Capping Option were pursued, it would add, on average, just over 1 person-rem per year to the site-wide collective worker dose. DD&D activities across the site would add another 6 person-rem per year to the site-wide collective worker dose. Conversely, the cessation of SHEBA operations at TA-18 would reduce LANL's site-wide collective worker dose under the Expanded Operations Alternative by 10 person-rem per year.

Table 5–27 Projected Worker Exposure to Radiation under the Expanded Operations Alternative

	MDA Removal Option	***MDA Capping Option***
Collective worker dose (person-rem per year)	520	408
Number of workers with measurable dose	3,646	2,211
Excess LCF risk per year among worker population	0.31 [a]	0.24 [a]
Average individual worker measurable dose (millirem)	143	184
Excess LCF risk per year for average individual worker	8.6×10^{-5} [a]	0.00011 [a]
DOE limit on annual worker radiation exposure (millirem)	5,000	5,000
LANL average individual worker dose as a percentage of DOE limit (percent)	2.9	3.7

MDA = material disposal area, LCF = latent cancer fatality.
[a] Based on a risk estimate of 0.0006 LCFs per person-rem (see Appendix C).

Under the Expanded Operations Alternative – MDA Removal Option, the average individual worker dose of 143 millirem per year represents an increased risk of developing a latent fatal cancer of approximately 1 chance in 11,600 (8.6×10^{-5}) per year of operations. Under the Expanded Operations Alternative – MDA Capping Option, the average individual worker dose of 184 millirem per year represents an increased risk of developing a latent fatal cancer of approximately 1 chance in 9,100 (1.1×10^{-5}) per year of operations.

Waste management workers, who currently receive, on average, a dose of approximately 163 millirem annually, would receive less annual dose under the Expanded Operations Alternative after 2015. By the end of 2015, all legacy transuranic waste would have been removed from the site and shipped to the Waste Isolation Pilot Plant (WIPP). Direct penetrating radiation levels in Area G, which currently measure above background levels in certain areas, would decrease to within background levels by this time. Waste management workers would still process newly-generated transuranic waste at the proposed new Transuranic Waste Consolidation Facility to be built in either TA-50 or TA-63, but their exposures would be less than currently observed because the management of the newly-generated waste would not be as time-intensive as is currently required. Workers associated with retrieval of remote-handled transuranic waste from below-ground storage between 2011 and 2015 could see increases in radiation exposure, but their exposures would be monitored and engineering and administrative

controls would be used to maintain their exposures ALARA and within administrative control levels.

Nonionizing Radiation Consequences

Under the Expanded Operations Alternative, negligible effects on LANL worker health from nonionizing radiation sources, infrared radiation from instrumentation and welding, lasers, magnetic and electromagnetic fields, and microwaves would likely continue.

Biological Agent Exposure Consequences

Under the Expanded Operations Alternative, effects on LANL worker health from normal operations would not be substantially different than those under the No Action Alternative.

Chemical Exposure Consequences

Under the Expanded Operations Alternative, chemical exposure consequences to workers would likely be small and not substantially different than those under the No Action Alternative.

Occupational Injuries and Illness

As shown in **Table 5–28**, the projected number of annual occupational injuries and illnesses would be higher under the Expanded Operations Alternative compared to the No Action Alternative. This is due to two main factors. First, the size of the workforce is expected to continue to grow under this alternative as discussed in Section 5.8.1.3, and, second, there is expected to be more construction, DD&D, and remediation work taking place under the Expanded Operations Alternative. The expansion of construction, DD&D, and remediation work is significant because these activities have higher incidence rates in terms of occupational injuries and illnesses than other types of work being performed onsite.

Table 5–28 Annual Projected Occupational Injuries and Illnesses Under the Expanded Operations Alternative.

	Total Recordable Cases	***Cases Resulting in Days Away, Restricted, or Transferred***
General Laboratory Operations [a]	292.4	153.1
Construction	21.3	10.4
Remediation (MDA Removal Option)	27.6	13.5
Decontamination, decommissioning, and demolition	2.6	1.3
Total	343.9	178.3

MDA = material disposal area.

[a] Based on LANL averages of 2.33 total recordable cases and 1.22 cases resulting in days away, restricted, or transferred per 200,000 hours worked.

While total recordable cases and cases resulting in days away, restricted or transferred would be 10 – 11 percent higher compared to the No Action Alternative, there would continue to be no fatalities expected under this alternative.

5.7 Cultural Resources

Potential impacts to cultural resources were assessed under the No Action, Reduced Operations, and Expanded Operations Alternatives. Cultural resources include archaeological resources, historic buildings and structures, and traditional cultural properties. Information used for impact assessment was derived from the results of systematic cultural resource inventories on LANL.

The analysis of impacts to cultural resources addressed potential direct and indirect impacts at each site from construction and operation. Direct impacts include those resulting from groundbreaking activities associated with new construction, building modifications, and demolition, as appropriate. Indirect impacts include those associated with reduced access to resource sites, as well as impacts associated with increased storm water runoff, increased traffic, and visitation to sensitive areas. The locations of known cultural resources were compared to the areas of potential effect from LANL activities. The potential for impacts from these activities to cultural resources was then assessed.

A summary of impacts is presented in **Table 5–29**.

5.7.1 No Action Alternative

The No Action Alternative is represented by the existing environment as it relates to cultural resources (see Section 4.7) together with actions that have been decided upon, but that have may not been fully implemented. These actions either were analyzed in other NEPA compliance reviews issued since the *1999 SWEIS* or in the *1999 SWEIS*. Impacts to cultural resources are described in terms of those projects that impact the site as a whole and those that affect specific technical areas. Key Facilities are addressed separately. Only those projects that have been evaluated in respective EAs as having an impact on cultural resources are addressed below.

Los Alamos National Laboratory Site-Wide Impacts

Two projects have been approved since publication of the *1999 SWEIS* that have the potential to impact cultural resources across a number of technical areas. These projects involve the conveyance and transfer of certain parcels of land at LANL to Los Alamos County and Department of the Interior to be held in trust for the Pueblo of San Ildefonso, and the management of the trails system at LANL. Other projects of a site-wide nature that have been determined not to have an impact on cultural resources include electrical power system upgrades, the Wildfire Hazard Reduction Program, disposition of Cerro Grande Fire structures, and the Security Perimeter Project (DOE 1999d, 2000a, 2000e, 2002i, 2003a, 2003d; NNSA 2004a, 2005a).

Table 5–29 Summary of Environmental Consequences on Cultural Resources

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site			
	Land Conveyance and Transfer: – Conveyance or transfer of known cultural resources out of the responsibility and protection of DOE. – Potential damage to cultural resources on conveyed or transferred parcels due to future development. – Potential impacts on protection and accessibility to American Indian sacred sites. Trails Management Program: – Enhanced protection	Same as No Action Alternative	Same as No Action Alternative plus: MDA Remediation Project: – No direct impacts expected for both options (that is, capping and removal). – Potential indirect adverse effects on resources located in vicinity of some MDAs and PRSs. Security-Driven Transportation Modifications Project: – No direct impacts. – Potential indirect adverse effects on historic site located in vicinity of TA-63 and the proposed bridge over Mortandad Canyon. – Pedestrian and vehicle bridges under all options could impact canyon views from traditional cultural properties.
Affected Technical Areas			
TA-3	No change in impacts to cultural resources.	Same as No Action Alternative	Center for Weapons Physics Research: – Two historic buildings, one eligible for the National Register of Historic Places and one that will be assessed for eligibility, would be removed. Replacement Office Buildings: – Potential adverse effects on nearby historic trail.
TA-21	No change in impacts to cultural resources.	Same as No Action Alternative	TA-21 DD&D: – Adverse effects on National Register of Historic Place-eligible historic buildings and structures.
Key Facilities			
Chemistry and Metallurgy Research (TA-3, TA-48, and TA-55)	Resulted in excavation of an archaeological site in TA-50.	Same as No Action Alternative	Same as No Action Alternative
High Explosives Processing Facility (TA-16)	Adverse effect from demolition and remodeling of historic buildings.	Same as No Action Alternative	Same as No Action Alternative

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
High Explosives Testing Facility (TA-6, TA-22, and TA-40)	Adverse effect from demolition and remodeling of historic buildings.	Same as No Action Alternative	Same as No Action Alternative
Pajarito Site (TA-18)	No change in impacts to cultural resources.	Same as No Action Alternative	Potential adverse effect from demolition of historic buildings.
Radiochemistry Facility (TA-48)	No change in impacts to cultural resources.	Same as No Action Alternative	The Radiological Sciences Institute Project includes: – Potential adverse effects on two archeological sites located near Radiochemistry Building. – Potential adverse effect from demolition of Radiochemistry Building and other potentially historic buildings.
Radioactive Liquid Waste Treatment Facility (TA-50)	No change in impacts to cultural resources.	Same as No Action Alternative	– Changes to the existing Radioactive Liquid Waste Treatment Facility could alter its original appearance. – Minimal impact on historic buildings possibly requiring documentation to resolve adverse effects.
Solid Radioactive and Chemical Waste Facilities (TA-50 and TA-54)	No change in impacts to cultural resources.	Same as No Action Alternative	– Potential indirect effects on cultural resources located in vicinity of project associated activities in TA-54. – Removal of white-colored domes would have a positive impact on views from traditional cultural properties located on adjacent lands of the Pueblo of San Ildefonso.
LANSCE (TA-53)	No change in impacts to cultural resources.	Same as No Action Alternative	– Potential adverse effect to LANSCE or other historic buildings experiencing internal modifications.
Radiography Facility (TA-55)	No change in impacts to cultural resources.	Same as No Action Alternative	– Adverse effect to the potentially historic TA-55-41 building.
Bioscience Facilities	No change in impacts to cultural resources.	Same as No Action Alternative	The Science Complex Project includes: – Under all options, an eligibility assessment of the buildings to be replaced by the new Science Complex would be required. – Potential adverse effects on two prehistoric archeological sites under Option 1. – No adverse effects to cultural resource sites under Options 2 and 3.
Remote Warehouse and Truck Inspection Station (TA-72)	No change in impacts to cultural resources.	Same as No Action Alternative	– Potential adverse effects on three archeological sites.

MDA = material disposal area, PRS = potential release site, TA = technical area, DD&D = decontamination, decommissioning, and demolition, LANSCE = Los Alamos Neutron Science Center.

The conveyance and transfer of 10 tracts of land to Los Alamos County and the Department of the Interior to be held in trust for the Pueblo of San Ildefonso would have both direct and indirect impacts on cultural resources. To date, eight parcels have been conveyed or transferred in whole or in part (see Table 4–2). Direct impacts have included the transfer of known cultural resources and historic properties out of the responsibility and protection of DOE, including resources eligible for the National Register of Historic Places. It should be noted that a data recovery plan was written to resolve the adverse effects of the conveyance of three tracts cited for development with 49 archaeological sites eligible for the National Register of Historic Places to the County of Los Alamos. The implementation of this data recovery plan is ongoing as of 2005. In addition, 34 archaeological sites are included within 3 protective easements at a single tract to be conveyed to the County for recreational purposes (LANL 2002a). The disposition of each of the tracts also affects the protection and accessibility to American Indian sacred sites or sites needed for the practice of traditional religion. In addition, the disposition of the tracts would potentially affect the treatment and disposition of any human remains, funerary objects, sacred objects, and objects of cultural patrimony that may be discovered on the tracts. Indirect impacts of the conveyance and transfer of land include potential future development of 826 acres (334 hectares) and use of tracts for recreational purposes. This action could result in physical destruction, damage, or alteration of cultural resources on the subject tracts and in adjacent areas and disturbance of traditional religious practices (DOE 1999d).

The Trails Management Program would provide enhanced protection of cultural resources at LANL. Management activities would be coordinated with LANL archaeologists in consultation with appropriate American Indian Tribes to minimize damages to any cultural resources present along trail reaches. Where activities associated with trail maintenance or use would adversely affect a trail it could be closed to all or certain users until the involved segment of trail could be rerouted around the cultural resources. Alternately, certain trail segments could be closed periodically for American Indian use. If work necessary to close a trail to all user groups would result in an adverse effect on a cultural resource, a data recovery plan would be prepared and the State Historic Preservation Officer and appropriate American Indian Tribes would be consulted before such work commenced. New trails would not be constructed in locations that would result in adverse effects on cultural resources, either from trail users or maintenance workers (DOE 2003d).

Technical Area Impacts

Technical Area 3

One project within TA-3, the installation of combustion turbine generators, has undergone NEPA compliance review since issuance of the *1999 SWEIS* and has not been fully implemented. The analysis presented in the project-specific EA determined that there would be no impact on cultural resources from implementation of this project (DOE 2002l).

Technical Area 54

Within TA-54, the implementation of corrective measures at MDA H has undergone NEPA compliance review since issuance of the *1999 SWEIS* and has not been fully implemented. The

analysis presented in the project-specific EA supported NNSA's determination that implementation of this action would not significantly impact cultural resources (DOE 2004e).

Key Facilities Impacts

Since the issuance of the *1999 SWEIS*, NEPA compliance documentation has been prepared for three currently active projects related to Key Facilities. These include the Chemistry and Metallurgy Research Building Replacement at TA-55, Weapons Manufacturing Support Facility at TA-16, and the Twomile Mesa Complex at TA-22. It has been determined that each of these projects has the potential to have some impact on cultural resources.

Chemistry and Metallurgy Research Building

Construction of the new Chemistry and Metallurgy Research Building Replacement was determined not to have an adverse impact on cultural resources at TA-55 (DOE 2003f). A parking lot associated with the complex to be located in TA-50 will impact an archaeological site. This site, the "Romero Cabin Site" was originally excavated in the 1980s. A data recovery plan was written to resolve the adverse effect of construction of the parking lot at the cabin site. The implementation of this data recovery plan is ongoing as of 2005 (LANL 2006).

High Explosives Processing

The planned consolidation and refurbishment of the TA-16 Weapons Manufacturing Support Facility will not affect the one prehistoric archaeological site that is located in the area. However, the demolition and remodeling of various buildings, which is a part of the project, will have an adverse effect on National Register of Historic Places-eligible historic structures, many of which were constructed in the 1950s. A Memorandum of Agreement between NNSA and the State Historic Preservation Officer for resolution of adverse effects will be prepared following State Historic Preservation Officer concurrence on the National Register of Historic Places eligibility assessment of these structures. The Advisory Council on Historic Preservation will be notified of the Memorandum of Agreement and will have an opportunity to comment (DOE 2002k).

The planned consolidation and construction that is part of the Twomile Mesa Complex at TA-22 will not impact any recorded prehistoric or historic sites. However, the demolition of various historic buildings as a part of that action will have an adverse effect on National Register of Historic Places-eligible and potentially eligible historic structures. As noted above for the TA-16 Weapons Manufacturing Support Facility, a Memorandum of Agreement between NNSA and the State Historic Preservation Officer for resolution of adverse effects will be prepared following State Historic Preservation Officer concurrence on the National Register of Historic Places eligibility assessment. The Advisory Council on Historic Preservation will be notified of the Memorandum of Agreement and will have an opportunity to comment (DOE 2003g).

5.7.2 Reduced Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Under the Reduced Operations Alternative, impacts to cultural resources from those actions discussed for the No Action Alternative (see Section 5.7.1) would still take place.

Key Facilities Impacts

Activity levels at certain Key Facilities would change. High explosives processing and testing would be reduced by 20 percent, LANSCE would cease operation and be placed into a safe shutdown mode, and buildings at the Pajarito Site (TA-18) would undergo safe shut down as well. The Pajarito Site would then be dropped from the list of Key Facilities. Since there would be no change in cultural resources associated with the reduction in high explosives processing and testing, or the closure of LANSCE and TA-18, these actions are not addressed further.

5.7.3 Expanded Operations Alternative

The Expanded Operations Alternative reflects proposals that would expand the overall operations level at LANL above those established for the No Action Alternative. Thus, this alternative includes those actions addressed under that alternative (see Section 5.7.1). Additionally, the Expanded Operations Alternative includes a number of new projects that have the potential to impact cultural resources. However, not all new projects would affect these resources, since many would involve actions within, or modifications to, existing structures or construction of new facilities within previously developed areas of LANL. Only those projects that could impact cultural resources are addressed below.

Los Alamos National Laboratory Site-Wide Impacts

There are two options (capping and removal) for the remediation of MDAs at LANL; cultural resources impacts would be generally similar for both options. The surfaces of the MDAs would be disturbed whether they were capped or contamination removed. Because no archaeological resources are located within any of the MDAs, neither option would directly impact such sites. Risk of impact to cultural resources during remediation of any of the hundreds of other PRSs at LANL would depend on the situation and the corrective measure implemented, if any. Unlike the MDAs, many of the PRSs (such as firing sites) contain only surface or near-surface contamination that could be recovered relatively easily.

Indirect impacts to cultural resources from remedial actions are possible due to increased erosion resulting from clearing, capping, removal, or contamination recovery operations, and from workers or equipment leaving the work area. In those cases where archaeological resource sites and historic buildings and structures are located near work areas, site boundaries would be marked and the site fenced, as appropriate. As one example, a building eligible for inclusion in the National Register of Historic Places is within the solid waste management units comprising Firing Site R-44 in TA-15. However, if remediation of R-44 is required by NMED, remediation would take place in a manner protective of the building.

Most actions associated with implementing the Security-Driven Transportation Modifications Project would have little or no impact on cultural resources since no known cultural sites are located within any of the areas to be disturbed. A historic site is situated near an area to be disturbed within TA-63; however, direct impacts would be unlikely. Prior to any disturbance, site boundaries would be marked and the site fenced, as appropriate. If previously unknown resources were identified during ground disturbing activities procedures as set forth in *A Plan for the Management of the Cultural Heritage at Los Alamos National Laboratory, New Mexico* would be followed (LANL 2005h). The proposed vehicle and pedestrian bridges over Ten Site Canyon would be highly visible from both nearby and distant locations. Thus, the potential exists that they may degrade views of the canyon from sites identified by American Indian and Hispanic communities as traditional cultural properties.

Under Auxiliary Actions A and B of the Security-Driven Transportation Modifications Project bridges would be built over Mortandad Canyon and Sandia Canyon, respectively. Since the corridors within which these would be constructed do not contain any known cultural resource sites, it is unlikely that construction of the bridges (or associated roadways) would have a direct impact on such resources. There are a number of prehistoric sites and one historic site located to the east and west of the proposed Mortandad Canyon bridge corridor. Due to the relative proximity of these resources to the bridge corridor, it may be necessary to mark and fence sites, as appropriate. No cultural resource sites are located in the vicinity of the Sandia Canyon bridge corridor. In the event that a previously unknown resource is identified during ground disturbing activities associated with the proposed options procedures set forth in LANL's cultural heritage management plan (LANL 2005h) would be followed. As noted above for the road and pedestrian bridges over Ten Site Canyon, the potential exists for the degradation of views of the canyon from sites identified by American Indian and Hispanic communities as traditional cultural properties (see Appendix J).

Technical Area Impacts

Three projects are being proposed that would have potential impacts on cultural resources within TA-3 and TA-21. These are related to the Center for Weapons Physics Research and the Replacement Office Buildings in TA-3 and TA-21 DD&D.

Technical Area 3

The proposed site of the Center for Weapons Physics Research is in an already-developed area of TA-3. However, TA-03-0028 is a potentially significant historic building that would be removed. Prior to its demolition it will be assessed for inclusion in the National Register of Historic Places in 2006. The current Administration Building (TA-03-0043) has been formally declared as eligible for the National Register of Historic Places and a Memorandum of Agreement has been signed regarding required documentation prior to its removal.

Although are no cultural resource sites that are eligible for the National Register of Historic Places are located in TA-3 in the vicinity of the Replacement Office Buildings, a historic tail located to the south of the parking lot must be managed as such until formally determined otherwise. Due to its proximity to the proposed project, there could be potential adverse effects to

the trail from construction. Appropriate measures, such as fencing the trail, would be implemented to resolve any adverse effects.

Technical Area 21

Decontamination and demolition of buildings and structures at TA-21 would have direct effects on the National Register of Historic Places-eligible historic buildings and structures that are associated with the Manhattan Project and Cold War years at LANL. In total, there are 15 historic buildings and structures in TA-21; however, a number of these are located within the parcel that has been conveyed to Los Alamos County. With regard to those historic buildings and structures that would be affected, NNSA, in conjunction with the State Historic Preservation Officer, has developed documentation measures to resolve adverse effects to eligible properties. Prior to demolition, these measures would be incorporated into a formal Memorandum of Agreement between the NNSA and the New Mexico Historic Preservation Division. The Advisory Council on Historic Preservation would be notified of the Memorandum of Agreement and would have an opportunity to comment.

Key Facilities Impacts

Four projects are being proposed that are related to Key Facilities at LANL under the Expanded Operations Alternative.

Pajarito Site

Prehistoric resources (specifically, 40 cavates and a rock shelter) and historic resources (specifically the Ashley Pond cabin) are located within the Pajarito Site (TA-18). These would continue to be protected during DD&D activities. Three LANL-associated buildings located within TA-18 have been identified as eligible for listing on the National Register of Historic Places. These include the Slotin Building (18-1) and two other buildings (18-2 and 18-5). As noted previously, NNSA, in conjunction with the State Historic Preservation Officer, has developed documentation measures to resolve adverse effects on eligible properties at LANL. Appropriate measures would be defined in a Memorandum of Agreement prior to any DD&D activities. The Advisory Council on Historic Preservation would be notified of the Memorandum of Agreement and would have an opportunity to comment.

Radiochemistry Building

Construction of the Radiological Sciences Institute would not directly impact prehistoric cultural resources since none are located within areas to be disturbed by construction. However, one prehistoric site is located across the access road from the existing Radiochemistry Building, and the Radiochemistry Building itself is considered a historic structure. New construction in the area of the prehistoric site would require that the site boundaries be marked and the site fenced.

Before demolition could begin on parts of the Radiochemistry Building or other structures to be replaced by the Radiological Sciences Institute, NNSA, in conjunction with the State Historic Preservation Officer would implement documentation measures to resolve adverse effects to eligible properties. These measures would be incorporated into a formal Memorandum of Agreement between NNSA and the New Mexico Historic Preservation Division. The Advisory

Council on Historic Preservation would be notified of the Memorandum of Agreement and would have an opportunity to comment. Impacts from construction and operation of the Radiological Sciences Institute on traditional cultural properties are unlikely since most development would take place within previously disturbed portions of TA-48. Potential views of TA-48 from any traditional cultural properties located in the vicinity would remain largely unchanged (see Appendix G).

Radioactive Liquid Waste Treatment Facility

Under the Proposed Action for replacing the RLWTF, effects to cultural resources would be minimal. Impacts to cultural resources in the vicinity of the pipeline and evaporation basins would be avoided during the siting process. However, if the pipeline alignment were to encroach on archaeological sites near the evaporation basins, the archaeological sites would require testing or excavation. This option would result in minimal effects on historic buildings since removal of later annexes to the RLWTF would not likely affect the original historic fabric of the building. However, changes in the process area of the RLWTF would require historic documentation before any equipment is removed from the building. The environmental consequences on cultural resources of the option to build and operate a single new low-level radioactive waste/transuranic facility would be the same as the Proposed Action option of building two separate buildings to house these facilities.

The New Construction and Renovation Option for the RLWTF could also result in minimal adverse effects on cultural resources. As discussed under the Proposed Action, impacts to archaeological sites near the pipeline route and evaporation basins would be avoided. In addition, changes to the structure of the existing RLWTF would alter the original historic appearance of the building. Removal of equipment, modification to the building, and demolition of the annexes would require documentation and consultation with the New Mexico Historic Preservation Office. For all options, mitigation plans would have to be implemented before or during the implementation of the project.

Solid Radioactive and Chemical Waste Facilities

Impacts to cultural resources from Waste Management Facilities Transition activities would be similar under both options (capping and removal). All activities taking place in TA-54, including new construction and removal of the white-colored domes, would occur within developed areas. Thus, there would be no direct impact on cultural resources. However, a number of cultural resource sites are located nearby; thus, the potential exists for indirect impacts to these resources. To ensure these resources would not be affected under either alternative, cultural resource site boundaries would be marked and fenced, as appropriate. Placement of the proposed Transuranic Waste Processing Facility at TA-50 or TA-63 would not impact cultural resources since the potential facility locations are not situated near any cultural resources sites.

Adverse impacts on traditional cultural properties from activities associated with Waste Management Facilities Transition activities are unlikely since most activities would take place either within previously disturbed portions of TA-50 and TA-54 or in an existing structure. However, removal of the white-colored domes at TA-54 would have a positive impact on views from Pueblo of San Ildefonso lands, which border the TA to the north.

Los Alamos Neutron Science Center

The LANSCE accelerator building has been determined to be eligible for listing on the National Register of Historic Places. Although project-related modifications would not affect the external appearance of the structure, it would be necessary to make a determination of potential adverse effects and document existing conditions, as appropriate. Additionally, any other significant historic buildings at TA-53 which could experience internal modifications would have to be evaluated for National Register of Historic Places eligibility status; these buildings must be considered potentially eligible until formally assessed.

Radiography Facility (TA-55)

Under all options Building 55-41 would be either demolished in whole or in part or renovated. TA-55-41 is a potentially significant historic building that has yet to be assessed for National Register of Historic Places eligibility status. If determined to be eligible prior to any demolition activities taking place, DOE in conjunction with the State Historic Preservation Office, would implement documentation measures such as preparing a detailed report containing the history and description of the affected properties. These measures would be incorporated into a formal Memorandum of Agreement between DOE and the New Mexico Historic Preservation Division to resolve adverse effects. The Advisory Council on Historic Preservation would be notified of the Memorandum of Agreement and would have an opportunity to comment.

Science Complex

Two archaeological sites are situated in the vicinity of the proposed Northwest TA-62 location and both sites have been determined to be eligible for the National Registry of Historic Places. These two sites are at risk of either direct or indirect adverse effects by construction of the Science Complex. Construction activity, traffic and ground disturbance could damage portions or both sites. Mitigation measures would be taken as appropriate to resolve adverse effects in conjunction with the State Historic Preservation Office and Advisory Council on Historic Preservation. There would be no adverse effects on cultural resources from construction of the Science Complex under the Research Park Site or South TA-3 Site options. Under all options the buildings to be replaced by the Science Complex would have to be evaluated for their historic importance prior to their being demolished.

Remote Warehouse and Truck Inspection Station

The Remote Warehouse and Truck Inspection Station could impact the three recorded prehistoric archaeological sites at the proposed location. Mitigation measures would be taken in conjunction with the State Historic Preservation Office and Advisory Council on Historic Preservation, as appropriate, to ensure that construction activity, traffic and ground disturbances do not result in damage to the sites. The Mortandad Trail located east of the proposed project site leads to the Mortandad Cave Kiva National Historic Landmark and is closed to public access except for organized tours. Although the proposed project would not affect normal access to the trail, it would incorporate fencing around the perimeter of the Warehouse and Truck Inspection Station to protect sensitive areas, including the Mortandad Cave Kiva National Historic Landmark from unauthorized increased visitation.

5.8 Socioeconomics and Infrastructure

This section discusses the environmental effects of LANL operations on the socioeconomic region of influence and LANL site infrastructure. The effects are described for each of the alternatives.

5.8.1 Socioeconomics

The primary (direct) and the secondary (indirect) impacts of LANL activities on employment, salaries, and procurement are analyzed in this SWEIS. The primary impacts are projected based on the changes in employment (in terms of full-time equivalents at LANL). Changes in employment were projected based on information regarding activities at Key Facilities, and employment for the rest of LANL was assumed to remain the same.

Projected changes in employment were distributed among the Tri-County Area (the three counties closest to LANL: Los Alamos County, Rio Arriba County, and Santa Fe County). Changes in employment would likely result in additional, secondary changes in employment, salaries, and expenditures in the area, as well as changes in the demands on social services. These secondary impacts would occur within a regional economy because jobs added in a primary industry such as LANL create local opportunities for new employment in supporting industries. Analysis of these secondary economic and social impacts of LANL activities across the alternatives utilizes multipliers included in the *1999 SWEIS*. These multipliers were used to predict the total LANL socioeconomic impacts in the area. For example, if LANL were to expand employment by 100 full-time workers who would reside in the Tri-County area, the secondary effect of that action would be the addition of approximately 170 new secondary jobs in the Tri-County labor market. On the other hand, if LANL were to reduce employment by 100 full-time workers, the reverberating effect across the Tri-County economy would be the loss of 170 other jobs.

The projected changes in employment were then used to determine if there would be significant impacts in the Tri-County area in terms of the need for housing units, construction requirements at LANL, changes in local government finances, and the need for public services

Table 5–30 presents a summary of the expected socioeconomic changes for each of the proposed alternatives.

5.8.1.1 No Action Alternative

Los Alamos National Laboratory Site-Wide Impacts

LANL continues to be a major economic force within the three-county region of influence consisting of Santa Fe, Los Alamos, and Rio Arriba Counties (the Tri-County area). Table 4–33 shows the percentage of the region of influence employment that is directly associated with LANL operations. As shown in this table, LANL contractors directly employ about 12 percent of the total number of persons employed in the region of influence, and this level has remained relatively steady over a number or years.

Table 5–30 Summary of Socioeconomic Consequences

No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site		
LANL Employment		
2004 levels of employment used.	Decrease of 510 employees from 2004 levels. These cuts would be expected to result in the loss of about 865 indirect jobs in the region.	Increase by 2.3 percent per year so that from 2007 to 2011, an additional 920 to 2,240 employees would work at LANL and another 1,560 to 3,800 jobs would be created indirectly. This growth rate is consistent with the projected regional growth rate.
Housing		
No new housing units needed specific to changes in LANL's employment level.	Additional housing units would become available in the Tri-County area as a result of the projected decrease in LANL's employment level. These would likely offset the need for additional housing units in the region since the population would still be expected to grow, albeit at a slower rate (about 1.3 percent versus 2.3 percent).	Additional housing units would be required in the Tri-County area as a result of the projected increase in LANL's employment level along with the projected increase in the region's population. More LANL employees could be expected over time to reside in Rio Arriba or Santa Fe County, or other surrounding counties, as opposed to Los Alamos County where a shortage of available housing would likely continue. The number of housing units needed would be dependent on the number of workers relocating from outside the area. Overall, the number of units would likely be small compared to the overall needs in the Tri-County area.
Construction		
Completion of previously approved construction projects would likely draw workers already in the region who historically work from job-to-job.	Same as No Action Alternative.	An increase in the number of construction projects would likely draw workers already in the region who historically work from job-to-job.
Local Government Finance		
Annual gross receipts tax yields would likely remain at current levels in real terms.	Annual gross receipts tax yields directly and indirectly associated with LANL employment could decrease by approximately 1.4 percent.	Annual gross receipts tax yields directly and indirectly associated with LANL employment are projected to increase by between 2.6 and 5.8 percent from 2007 through 2011 over 2004 levels in real terms as a result of the increasing size of LANL's workforce during that time frame.
Services		
The demand for services such as police, fire and hospital beds would likely remain at current levels on a proportional basis compared to LANL employment. Regional population is projected to increase even if LANL employment remains flat, so there would be an increase in the demand for regional services, but the increased demand would not be driven by LANL growth.	The demand for services associated with LANL employment would likely decrease in proportion to the number of out of work LANL-related employees forced to leave the region. However, regional population would still be projected to increase, even if LANL employment were to decrease by the small levels envisioned in this alternative, so the demand for services would likely increase albeit at a slower pace than under the No Action Alternative.	The demand for services associated with LANL employment would likely increase in proportion to the number of additional LANL-related jobs added to the region. The number of additional school age children associated with these increases would be between 1,000 and 2,600 in the Tri-County area resulting in an estimated increase in needed public school funding from the state of $8 million to $21 million between 2007 and 2011. Most the additional services would be in Rio Arriba, Santa Fe and other surrounding counties because the population in Los Alamos County is projected to increase by a very small rate compared to the other counties.

At the end of 2004, LANL employed 13,261 individuals; nearly 17 percent more than the employment projection of 11,351 presented in the *1999 SWEIS*. From 1996 through 2004, employment at LANL increased by approximately 2.3 percent per year. During the same period, employment in the region of influence increased by an average of 2.4 percent annually. For the No Action Alternative, it is assumed that employment levels would no longer increase but would stay steady at the 2004 level.

Work Force

The completion of construction projects previously approved under completed NEPA compliance reviews would likely draw workers already present in the region of influence who historically have worked from job-to-job in the region. Thus, this sector of employment associated with LANL is not expected to grow as a result of the No Action Alternative.

Housing

No new housing units beyond regional trends would likely be needed under the No Action Alternative.

Local Government Finance

Under this alternative, the Tri-County annual gross receipts tax yields would be expected to grow at the same level as the population. Any changes in tax rates are assumed to be driven by the need to improve service levels to meet public demand in the case of an increase or correspondingly, a determination that service levels can be cut back or reduced in some way in the case of a tax cut.

Services

Annual school enrollment trends in the Tri-County area would likely continue as a result of projected growth within the counties unrelated to LANL. The demands for police, fire, and other municipal services as a consequence of LANL employment needs would also be expected to remain at current levels.

5.8.1.2 Reduced Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Under the Reduced Operations Alternative, employment at LANL could decrease by approximately 3.8 percent, or 510 employees, as a result of closing LANSCE, reducing high explosives processing and testing by 20 percent, and cessation of TA-18 activities. This would equate to a projected employment level of about 12,750 in 2007 under this alternative. In addition to the direct positions projected to be lost at LANL, indirect jobs would also be expected to be lost. Under this alternative, about 865 indirect positions are projected to be lost.

If these workers remained in the region of influence in 2007 and were unable to immediately find new employment, regional unemployment rates would be expected to increase by approximately 1.0 percent. Because these projected decreases are less than 1 percent of the total civilian labor

force for the region of influence, the changes would not be expected to result in any significant change in the regional economy. Similar swings in LANL employment were seen recently with no apparent impact on the regional economy. For example, employment levels at LANL decreased by approximately 3 percent from 1999 to 2000, while the number of persons employed in the region of influence increased by 4 percent during the same time period. A similar decrease was seen from 2003 to 2004 when LANL's employment decreased by 2.6 percent, while the number of persons employed in the region of influence increased by 1.3 percent.

Housing

In the event all of the persons affected by the projected reduction in LANL's workforce moved out of the region, available housing units in the region of influence would likely increase. However, this would not be expected to have a significant adverse impact on the region because the population is expected to be growing at the same time, so the available units would likely fill new demands. The immediate impacts on the housing market in Los Alamos County would likely be greater than in Santa Fe or Rio Arriba Counties because a greater percentage of LANL employees reside in Los Alamos County. However, given the lack of available units in Los Alamos County, any available units would likely be desired by others who may have wanted to move into the county but were unable to due to a lack of available housing. Thus, any initial increase in available units would likely be offset by pent-up demand (In 2000, only 5.5 percent of the housing units in Los Alamos County were vacant, as compared to over 13 percent in the State of New Mexico and 9 percent across the United States [Census 2000]).

Work Force

The anticipated construction impacts would be the same as under the No Action Alternative.

Local Government Finance

Under the Reduced Operations Alternative, the Tri-County annual gross receipts tax yields associated with LANL employment would be expected to decrease by approximately 1.4 percent if all of the affected employees relocated outside of the region. However, any reduction in tax revenues associated with the potential loss of LANL employees would likely be more than offset by projected increases in the regional workforce outside of LANL.

Services

Annual school enrollment in the Tri-County area could decrease as a result of the out migration of affected LANL employees and their families, as well as indirect personnel and their families. The potential loss would likely be offset by the influx of non-LANL employees into the region, since the region is expected to continue to grow, albeit at a slightly slower rate if the employment levels at LANL were to drop to levels projected under this alternative.

The demands for police, fire, and other municipal services would not be expected to be impacted by the projected changes in employment under this alternative since they would represent less than one percent of the regional demand.

5.8.1.3 Expanded Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Under the Expanded Operations Alternative, employment at LANL would continue to increase. Increases would be expected as a result of increased pit production, and increased remediation and DD&D activities under this alternative. In addition, increased work would likely come to LANL beyond current operations in areas that cannot be easily identified at this time but could be tied to expanding research efforts, such as homeland security. Similar increases have been seen in recent years at LANL. From 1996 through 2004, employment at LANL increased by about 2.3 percent annually.

If LANL's employment rate were to continue to increase at the same level experienced from 1996 through 2004, approximately 15,500 individuals could be employed by LANL by the end of 2011, as shown in **Table 5–31**, an increase of about 2,240 over the 2004 level. Of those, approximately 13,756 employees would likely reside within the region of influence. In addition to the direct hires associated with LANL, approximately 3,800 positions would likely be added indirectly as a secondary impact on the region's payrolls by the end of 2011.

Table 5–31 Projected Los Alamos National Laboratory Employment under the Expanded Operations Alternative

Year	*Projected LANL Employees*	*LANL Employees Residing in ROI*	*ROI Employed*	*LANL as a Percent of ROI Employed*
2007	14,178	12,583	111,949	11.2
2008	14,497	12,866	114,664	11.2
2009	14,824	13,156	117,444	11.2
2010	15,158	13,452	120,292	11.2
2011	15,500	13,756	123,209	11.2

ROI = Region of Influence.

Housing

An increase in LANL employment of approximately 920 in 2007 to an increase of 2,240 in 2011, along with associated indirect hires, would likely increase the need for housing in the region of influence. Although there is limited housing available in Los Alamos County at the current time, new housing is planned to commence within the next year. These units would likely be filled quickly and a larger percentage of LANL-related housing needs would still need to be accommodated by workers relocating to Santa Fe or Rio Arriba, or other nearby counties, as has been the trend in recent years.

Additional housing needs would not be expected to exceed regional growth projections because the region is already expected to grow by approximately 2.3 percent annually between 2000 and 2010 (LANL 2004e).

Work Force

Under the Expanded Operations Alternative, construction and remediation efforts at LANL would increase; but, similar to the No Action Alternative, these projects would likely be staffed by workers already present in the region of influence who historically work construction jobs in the region. Thus, this sector of employment associated with LANL is expected to grow as a result of the Expanded Operations Alternative but at a rate comparable with the operational growth rate.

Local Government Finance

Under this alternative, the Tri-County annual gross receipts tax yields would be expected to increase by between 2.6 and 5.8 percent in real terms as a result of additional workers being added to LANL's workforce from 2007 through 2011. Any increases in tax revenues that would be needed to offset the cost of additional services to support the associated increase in population under the Expanded Operations Alternative would be covered by these new employees.

Services

Annual school enrollment in the Tri-County area due to the increase in LANL employment (direct and indirect) would be projected to increase by between 1,000 and 2,600 students from 2007 to 2011. Additional annual funding assistance of about $8 million to $21 million from the State of New Mexico would be required for public school operations because of these enrollment increases. This would be part of an expected increase of about 6,000 to 10,000 in school age children in the Tri-County area.

In Los Alamos County, the school district would likely be able to absorb the anticipated new enrollment levels because the levels would not be expected to change significantly from current levels due to the lack of available housing units. If Los Alamos County approves plans to build additional homes in the county, the need for additional schools would need to be evaluated. In Rio Arriba County and the cities of Española and Santa Fe, this increase would be projected to be greater, as a larger portion of LANL's workforce would likely reside in these areas.

The demand for police, fire, and other municipal services would likely increase in proportion to the increase in population expected in each county.

5.8.2 Infrastructure

Site infrastructure includes the utility systems required to support the construction and/or modification and operation of LANL facilities. It includes the capacities of the electric power transmission and distribution system, natural gas and liquid fuel (fuel oil, diesel fuel, and gasoline) supply systems, and the water supply system. The region of influence for utility infrastructure resources includes the LANL site encompassing affected technical areas and individual facilities and the utility systems for electric power, natural gas, and water that serve LANL. A description of these utility systems, along with analyses of historic trends in LANL usage and other demands within the region of influence that supports this analysis, are provided in Section 4.8.2.

In general, potential infrastructure impacts were assessed by comparing projections of utility resource requirements under each alternative against site capacities. While many LANL facilities do not meter utility use, annual site-wide demands are known and were used, in part, to make projections for each of the alternatives considered in this SWEIS. These projections included identifying base trends in site-wide infrastructure requirements, as well as within the larger region of influence, which were then adjusted for project-specific actions within specific technical areas and at Key Facilities considered under each alternative. Any projected demand for infrastructure resources exceeding site availability can be regarded as an indicator of impact. Where projected demand approaches or exceeds capacity, further analysis for that resource is warranted.

Projected site utility infrastructure requirements under the Proposed Action and alternatives are summarized in **Table 5–32**.

5.8.2.1 No Action Alternative

Annual utility infrastructure requirements for current LANL operations and for other Los Alamos County users that rely upon the same utility system, along with current utility system capacities, are presented in **Table 5–33**. Current (2004) values are presented because they provide the reference baseline against which projections for the three proposed alternatives can be compared in this SWEIS. For the Expanded Operations Alternative analyzed in the *1999 SWEIS* (DOE 1999a) and selected in the subsequent Record of Decision, LANL operations were projected to require 782,000 megawatt-hours of electricity with a peak load demand of 113 megawatts, 1,840,000 decatherms of natural gas, and 759 million gallons (2.87 billion liters) of water annually. LANSCE alone was projected to require 437,000 megawatt-hours of electricity with a peak load demand of 63 megawatts. LANSCE operations have historically accounted for up to one-quarter to one-half of LANL's total water and electrical power demand, respectively. However, projections for LANSCE in the *1999 SWEIS* included operation of the Low-Energy Demonstration Accelerator. This facility only operated from late 1998 until it was shut down in December 2001. The Low-Energy Demonstration Accelerator was decommissioned in fiscal year 2003 (LANL 2005g). Thus, it will not be a factor in future LANSCE operations. Natural gas and water consumption was not projected for LANSCE, and the *1999 SWEIS* did not forecast utility infrastructure requirements for other Los Alamos County users.

While demand for key infrastructure resources (electricity, natural gas, and water) within the region of influence has generally exhibited an upward trend, there are notable exceptions. For electricity, total LANL demand increased by approximately 12 percent between 1999 and 2004 while other Los Alamos County user demands increased by 20 percent. In contrast, LANL natural gas consumption declined by nearly 20 percent between 1999 and 2004, but demand within the county increased by about 8 percent over roughly the same period. The decline at LANL is at least partly attributable to warmer than normal seasonal temperatures that have persisted since the early 1990s and possibly due to the switch from district heating plants to more efficient systems at individual LANL facilities. For water, total LANL demand also decreased by nearly 24 percent between 1999 and 2004, but this was offset by an increase of 18 percent among other Los Alamos County users, which accounts for the largest portion of total water use in the region of influence.

Table 5–32 Summary of Environmental Consequences on Site Infrastructure

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
LANL Site			
Total Alternative (annual)	Electricity requirements: 632,000 megawatt-hours total (486,000 megawatt-hours for LANL); 48 percent of system capacity Electric Peak Load: 112 megawatts total (92.3 megawatts for LANL); 75 percent of system capacity Natural gas requirements: 2,213,000 decatherms total (1,195,000 decatherms for LANL); 27 percent of system capacity Water requirements: 1,682 million gallons total (388 million gallons for LANL); 93 percent of system capacity	Electricity requirements: 497,000 megawatt-hours total (350,000 megawatt-hours for LANL); 38 percent of system capacity Electric Peak Load: 84.5 megawatts total (64.9 megawatts for LANL); 56 percent of system capacity Natural gas requirements: 2,190,000 decatherms total (1,171,000 decatherms for LANL); 27 percent of system capacity Water requirements: 1,605 million gallons total (310 million gallons for LANL); 89 percent of system capacity	Electricity requirements: 814,000 megawatt-hours total (668,000 megawatt-hours for LANL); 62 percent of system capacity Electric Peak Load: 145 megawatts total (125 megawatts for LANL); 97 percent of system capacity Natural gas requirements: 2,320,000 decatherms total (1,301,000 decatherms for LANL); 29 percent of system capacity Water requirements: 1,816 million gallons total (522 million gallons for LANL); 101 percent of system capacity
MDA Remediation	No change in utility demands	Same as No Action Alternative	Up to 68 million gallons liquid fuels and 30 million gallons of water for remediation activities.
Security Driven Transportation Modifications	No change in utility demands	Same as No Action Alternative	Up to 4.0 million gallons liquid fuels and 18.6 million gallons of water for construction.
Affected Technical Areas			
TA-3	TA-3 Co-Generation Complex upgrades would have a positive incremental impact on site electrical energy and peak load capacity, but natural gas consumption could increase to support higher electricity generation. Negligible, short-term increase in utility demands from constructing new office buildings, with no net increase in operational demands.	Same as No Action Alternative	Replacement Office Buildings–2.1 million gallons liquid fuels and 9.6 million gallons of water for construction; no net increase in utility demands for operations. Center for Weapons Physics Research–2.7 million gallons liquid fuels and 14.4 million gallons of water for construction; no net increase in utility demands for operations.
TA-18	No change in utility demands	Same as No Action Alternative	Negligible, short-term increase in utility demands from DD&D of TA-18 buildings.
TA-21	No change in utility demands	Same as No Action Alternative	Negligible, short-term increase in utility demands from DD&D of structures.

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
TA-54	Negligible, short-term increase in utility demands from MDA H closure activities.	Same as No Action Alternative	Same as No Action Alternative
TA-61	No change in utility demands	Same as No Action Alternative	Negligible temporary increase in utility demands, especially liquid fuels and water, from excavation.
Key Facilities			
Chemistry and Metallurgy Research (TA-3, TA-48, and TA-55)	Negligible, short-term increase in utility demands from DD&D of old facility at TA-3 and construction of new facility at TA-55. Little or no change in utility demands from Chemistry and Metallurgy Research Building Replacement operation when moved to TA-55.	Same as No Action Alternative	Same as No Action Alternative
Sigma Complex (TA-3)	No change in utility demands	Same as No Action Alternative	Same as No Action Alternative
Machine Shops	No change in utility demands	Same as No Action Alternative	Same as No Action Alternative
Materials Science Laboratory	No change in utility demands	Same as No Action Alternative	Same as No Action Alternative
Metropolis Center	No change in utility demands	Same as No Action Alternative	Moderate to major increase in electrical energy, peak load, and water demands over the No Action due to increased operational levels.
High Explosives Processing Facility (TA-16)	Negligible, short-term increase in utility demands from TA-16 Engineering Complex activities and demolition of structures.	Same as No Action Alternative	Potential for negligible increase in operational utility demands.
High Explosives Testing Facility (TA-6, TA-22, and TA-40)	Negligible to minor, short-term increase in utility demands from construction of 15 to 25 new structures within the Twomile Mesa Complex and removal or demolition of vacated structures.	Same as No Action Alternative.	Same as No Action Alternative
Tritium Facility (TA-21)	No change in utility demands	Same as No Action Alternative	Negligible, short-term increase in utility demands from DD&D of all TA-21 tritium buildings as part of the project to decommission all of TA-21.
Pajarito Site (TA-18)	No change in utility demands	Negligible decrease in site-wide operational utility demands from Pajarito Site shutdown.	Negligible, short-term increase in utility demands from DD&D of all TA-18 buildings.
Target Fabrication Facility	No change in utility demands	Same as No Action Alternative	Same as No Action Alternative

	No Action Alternative	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Bioscience Facilities	No change in utility demands	Same as No Action Alternative	Science Complex–4.7 million gallons liquid fuels and 24 million gallons of water for construction; no net increase in utility demands for operations
Radiochemistry Facility (TA-48)	No change in utility demands	Same as No Action Alternative	Radiological Science Institute–4.3 million gallons liquid fuels and 22.4 million gallons of water for construction; no net increase in utility demands for operations
Radioactive Liquid Waste Treatment Facility (TA-50)	No change in utility demands	Same as No Action Alternative	Radioactive Liquid Waste Treatment Facility –up to 504,000 gallons liquid fuels and 2.7 million gallons of water for construction; no net increase in utility demands for operations. Negligible short-term increase in utility demands from DD&D of existing Radioactive Liquid Waste Treatment Facility.
LANSCE (TA-53)	No change in utility demands	Moderate to major decrease in infrastructure resource requirements due to shut down of operations with a minor reduction within the Los Alamos region.	LANSCE Refurbishment– Negligible, short-term increase in utility demands from construction. Moderate increase in electrical energy, peak load, and water demands over the No Action due to increased operational levels.
Solid Radioactive and Chemical Waste Facilities (TA-50 and TA-54)	No change in utility demands	Same as No Action Alternative	Waste Management Facilities Transition–Up to 895,000 gallons liquid fuels and 4.9 million gallons of water for construction; negligible incremental increase in utility demands for operations.
Plutonium Facility Complex (TA-55)	No change in utility demands	Same as No Action Alternative	Plutonium Facility Complex Refurbishment and Radiography Facility–Negligible, short-term increase in utility demands for construction; minor increase in utility demands for operations to support increased pit production.
Remote Warehouse and Truck Inspection Station (TA-72)	No change in utility demands	Same as No Action Alternative	Up to 536,000 gallons liquid fuels and 2.0 million gallons of water for construction; negligible incremental increase in utility demands for operations.

MDA = material disposal area; TA = technical area, DD&D = decontamination, decommissioning, and demolition; LANSCE = Los Alamos Neutron Science Center.
Note: To convert gallons to liters, multiply by 3.78533.

Table 5–33 Current Infrastructure Requirements and System Capacities for the Los Alamos National Laboratory Region of Influence

Resource	*System Capacity*	*Current Requirement*		*Total Requirement*
		LANL	*Other Los Alamos County Users*	
Electricity				
Energy (megawatt-hours per year)	1,314,000 [a]	413,392	127,429	540,821
Peak load demand (megawatts)	150 [a]	69.4	16.2	85.6
Fuel				
Natural gas (decatherms per year)	8,070,000 [b]	1,149,936	931,940	2,081,876
Water (million gallons per year)	1,806 [c]	347	1,035	1,382

[a] Electrical energy and peak load capacity reflect the current import capacity of the electric transmission lines that deliver electric power to the Los Alamos Power Pool and completion of upgrades at the TA-3 Co-Generation Complex, adding 40 megawatts (350,400 megawatt-hours) of generating capacity. Values do not reflect completion of a new transmission line and other power grid upgrades that are ongoing.
[b] Reflects contractually-limited capacity of the natural gas system serving the Los Alamos area (see Section 4.8.2.2).
[c] Equivalent to the total water rights from the regional aquifer.
Note: A decatherm is equivalent to 1,000 cubic feet.
Source: Arrowsmith 2005, Glasco 2005, LANL 2005g.

Los Alamos National Laboratory Site-Wide Impacts

Projected annual utility infrastructure requirements under the No Action Alternative are presented in **Table 5–34**. The No Action Alternative represents a future baseline that includes projects that have already been implemented to some degree (and may already be reflected in the current baseline values), are in the process of being implemented, or would be implemented fully between now and 2011. These are independent of subsequent project decisions at LANL. These ongoing activities add to the overall trend in utility infrastructure demand in the Los Alamos area as a whole.

Table 5–34 Projected Site Infrastructure Requirements under the No Action Alternative

Resource	*LANL Requirements*	*Other Requirements* [a]	*Total Requirements*	*Percent of Capacity* [b]
Electricity				
Energy (megawatt-hours per year)	486,000	146,000	632,000	48
Peak load demand (megawatts)	92.3	19.6	112	75
Fuel				
Natural gas (decatherms)	1,195,000	1,018,000	2,213,000	27
Water (million gallons per year)	388	1,294	1,682	93

[a] Projections through 2011 for electrical energy, peak load, natural gas, and water also include projected usage for other Los Alamos County users that rely upon the same utility system as LANL.
[b] A calculation based on the system capacity as shown in Table 5–33.
Note: A decatherm is equivalent to 1,000 cubic feet.
Sources: Projections based on Arrowsmith 2005, Glasco 2005, DOE 2002h, LANL 2004e, 2005g, 2006.

Additionally, the infrastructure requirements projections are made for operations at LANL Key Facilities actually approaching operational levels forecast in the *1999 SWEIS* and associated Record of Decision. The level of operations forecast in the *1999 SWEIS* have not been realized to date, and LANL operational demands have trended well below the *1999 SWEIS* projections as

a result (see Table 5–34). Some of the discrepancy between forecast and actual trends in infrastructure demands also reflects the rather conservative and bounding approach used in the original estimates. As such, the projections made in this SWEIS, to the extent possible, account for those key factors that would prevent LANL from practically realizing the infrastructure resource demands forecast in the *1999 SWEIS*. Factors considered for LANSCE operations were previously discussed. While funding shortfalls have limited hours of operation at LANSCE and reduced utility demands, aging equipment physically limits the total operational availability of LANSCE to the extent that the levels of operations forecast in the *1999 SWEIS* would not be reasonable under the No Action Alternative.

No infrastructure capacity constraints are anticipated from implementation of the No Action Alternative in the short term, as LANL operational and Los Alamos area demands on key infrastructure resources (electricity, natural gas, and water) have trended below previously forecasted levels. Under this alternative, total annual electricity, electric peak load, natural gas, and water requirements would be about 48 percent, 75 percent, 27 percent, and 93 percent, respectively, of the capacity of the utility systems that serve LANL.

The total peak load demand is projected to consume 75 percent of the Los Alamos Power Pool's peak load capacity by 2011. This includes consideration of the generating capacity of the TA-3 Co-Generation Complex at LANL which will have an electric generating capacity of at least 40 megawatts after a new turbine is installed by the end of 2006. Ongoing upgrades to the electrical power transmission and distribution system including construction of a third transmission line would allow the import of additional power and support a higher electric peak load beyond 2006.

Natural gas is abundant in New Mexico, and the region has a high import capacity. Ongoing upgrades to the natural gas distribution system by the Public Service Company of New Mexico should ensure the adequacy and reliability of natural gas (see Section 4.8.2.2). Completion of upgrades to the TA-3 Co-Generation Complex could make its use more attractive for electrical energy production by LANL as compared to the past and, thus, could otherwise support an increase in natural gas consumption over time. Regardless, an adequate capacity margin is forecast to be maintained under the No Action Alternative.

Total water demand within the region of influence could exceed 90 percent of Los Alamos County's rights to withdraw water from the regional aquifer. This is despite the fact that projections indicate that LANL itself would remain within its annual water use ceiling quantity (542 million gallons [2,050 million liters]) under the No Action Alternative (see Section 4.8.2.3). As described in Section 4.8.2.3, Los Alamos County has completed feasibility studies to access up to 391 million gallons (1,500 million liters) of water per year from the San Juan-Chama Transmountain Diversion Project; however, the earliest that this water could be made available for use would be 2010 (Glasco 2005).

Technical Areas Impacts

Construction and related DD&D requirements for electricity, fuels, and water in the affected technical areas under this alternative are expected to be negligible, including for replacement office building construction and continued upgrades to the Co-Generation Complex in TA-3 and

MDA H closure activities in TA-54. In the short term, these activities would entail short-term spikes in utility infrastructure resource demands on a TA basis, but this would have a negligible impact on the capacity of affected utility systems and on the overall trend in utility resource demands.

Technical Area 3

New facility operations in TA-3 would likely have a negligible impact on overall trends in infrastructure resource requirements, as the new facilities would generally replace older and less resource-efficient facilities. Further, upgrades at the TA-3 Co-Generation Complex would have a positive impact on the Los Alamos Power Pool's electric power availability by increasing LANL's onsite generating capacity and improving the reliability of the complex as discussed above. The completed upgrades could, however, contribute to higher natural gas consumption should the facility be called upon to provide more electricity in the future as previously discussed.

Key Facilities Impacts

Completion of programmed construction projects and related DD&D activities including the Chemistry and Metallurgy Research Building Replacement at TA-55, the Weapons Manufacturing Support Facility at TA-16, and construction of new dynamic experimentation support facilities within the Twomile Mesa Complex (part of TA-6, TA-22, and TA-40) would entail short-term spikes in utility resource demands. These activities would have a negligible impact on the capacity of affected utility systems and on the overall trend in utility resource demands.

Operation of the aforementioned new facilities would not be expected to result in a measurable overall increase in utility infrastructure demands, as the modern facilities would replace antiquated and less resource-efficient facilities, whereby an economy of scale would be achieved in operational efficiency. For example, completing construction of the 15 to 25 new buildings within the Twomile Mesa Complex would replace about 59 structures currently used for such operations.

5.8.2.2 Reduced Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Projected annual utility infrastructure requirements under the Reduced Operations Alternative are presented in **Table 5–35**. Utility infrastructure demand from actions under the No Action Alternative would continue with certain operational reductions under this alternative. Reductions in the level of activity in high explosives processing and high explosives testing would have a negligible to minor impact on utility infrastructure requirements overall, as most other ongoing projects and activities would move forward as under the No Action Alternative. However, the entire LANSCE complex and TA-18 Pajarito Site would be placed into safe, shutdown mode under this alternative, although not all activities and associated utility demands would cease entirely. LANSCE accelerator and support operations currently demand a relatively large share (about 25 percent) of LANL's electricity and water. As such, shutdown of LANSCE would

result in a measurable reduction in infrastructure resource demands site-wide as compared to both the No Action Alternative and current operations. Under this alternative, total annual electricity, electric peak load, natural gas, and water requirements would be reduced to about 38 percent, 56 percent, 27 percent, and 89 percent, respectively, of the capacity of the utility systems that serve LANL.

Table 5–35 Projected Site Infrastructure Requirements under the Reduced Operations Alternative

Resource	*LANL Requirements*	*Other Requirements* [a]	*Total Requirements*	*Percent of Capacity* [b]
Electricity				
Energy (megawatt-hours per year)	350,000	146,000	497,000	38
Peak load demand (megawatts)	64.9	19.6	84.5	56
Fuel				
Natural gas (decatherms)	1,171,000	1,018,000	2,190,000	27
Water (million gallons per year)	310	1,294	1,605	89

[a] Projections through 2011 for electrical energy, peak load, natural gas and water also include projected usage for other Los Alamos County users that rely upon the same utility system as LANL.
[b] A calculation based on the system capacity as shown in Table 5–33.
Note: A decatherm is equivalent to 1,000 cubic feet.
Source: Projections based on Arrowsmith 2005, Glasco 2005, DOE 2002h, LANL 2004e, 2005g, 2006.

Technical Area Impacts

Operational demands on utility infrastructure under this alternative would be similar to those under the No Action Alternative on a TA basis (except for TA-53), as base requirements would not be appreciably reduced due to high explosives processing and high explosives testing reductions.

Key Facilities Impacts

Los Alamos Neutron Science Center

Shut down of LANSCE operations is projected to result in a moderate to major reduction in electrical energy, electric peak load demand, and water use at TA-53 over the No Action Alternative. This action alone would result in a minor overall reduction in demands within the region of influence. Natural gas demand within the region would not be measurably affected, as LANSCE operational demands for natural gas are a small percentage of that used by LANL as a whole and as usage by LANL and other Los Alamos County users is affected more by weather and onsite electricity generation needs.

Pajarito Site

Shut down of the Pajarito Site (TA-18), would result in a negligible site-wide decrease in operational utility needs.

5.8.2.3 Expanded Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Projected annual utility infrastructure requirements under the Expanded Operations Alternative are presented in **Table 5–36**. On a site-wide basis, numerous additional projects involving new facility construction, facility renovation, facility DD&D, and site closure activities would occur under this alternative that would affect numerous technical areas. Infrastructure requirements for these actions would be in addition to those needed for actions identified as part of the No Action Alternative. While these new activities collectively would result in a spike in utility resource demands principally for liquid fuels and water, their contribution to the overall trend in site-wide or Los Alamos area demands would be minor due to the extended timeframe over which the projects would be implemented, such as the MDA Remediation Project. Liquid fuels, mainly diesel fuel and gasoline, would be required to operate heavy equipment, vehicles, and other worksite equipment. However, unlike natural gas, which is the principal heating fuel used at LANL, liquid fuels are not considered to be limiting resources as they can be procured from offsite sources and supplied at the point of use as needed.

Table 5–36 Projected Site Infrastructure Requirements under the Expanded Operations Alternative

Resource	*LANL Requirements*	*Other Requirements* [a]	*Total Requirements*	*Percent of Capacity* [b]
Electricity				
Energy (megawatt-hours per year)	668,000	146,000	814,000	62
Peak load demand (megawatts)	125	19.6	145	97
Fuel				
Natural gas (decatherms)	1,301,000	1,018,000	2,320,000	29
Water (million gallons per year)	522	1,294	1,816	101

[a] Projections through 2011 for electrical energy, peak load, natural gas and water also include projected usage for other Los Alamos County users that rely upon the same utility system as LANL.
[b] A calculation based on the system capacity as shown in Table 5–33.
Note: A decatherm is equivalent to 1,000 cubic feet.
Source: Projections based on Arrowsmith 2005, Glasco 2005, DOE 2002h, LANL 2004e, 2005g, 2006.

For a number of the new projects at LANL that involve DD&D of existing facilities whose capabilities would be replaced by newly constructed facilities, an economy of scale would be achieved in operational efficiency resulting in a net decrease in utility demands. This would tend to moderate the overall trend of increasing utility demands at LANL and by Los Alamos County users that rely upon the same utility systems. Still, other projects would entail operational expansions that would result in a minor to moderate overall increase in demands for electricity, particularly in electric peak load demand, and water over the No Action Alternative. Only minor increases in natural gas demand are forecast. Under this alternative, total annual electricity, electric peak load, natural gas, and water requirements would be about 62 percent, 97 percent, 29 percent, and 99 percent, respectively, of the capacity of the utility systems that serve LANL.

The electric peak load capacity of the Los Alamos Power Pool could be approached due to increased operational demands at LANL combined with the trend of increasing demand on the part of other Los Alamos County users that is forecast to persist. The predicted spike in electric

peak load demand at LANL is primarily attributable to the Metropolis Center Increase in Level of Operations and the proposed LANSCE Refurbishment projects. Under the Expanded Operations Alternative, LANSCE operations would potentially require 208,000 megawatt-hours of electricity annually with a peak load demand of 51 megawatts compared to the Metropolis Center that would require about 131,400 megawatt-hours of electricity annually with a peak load demand of 18 megawatts. As discussed for the No Action Alternative, ongoing upgrades to the electrical power transmission and distribution system including construction of a third transmission line would allow the import of additional power and support a higher electric peak load beyond 2006.

As previously described, heating demand and associated natural gas consumption at LANL has steadily declined in recent years, despite higher overall activity levels at the site, due mainly to higher than normal seasonal temperatures. While implementation of the Expanded Operations Alternatives under this SWEIS could partly reverse this trend including operation of the TA-3 Co-Generation Complex for electric power generation, the capacity of the Los Alamos area natural gas delivery system is expected to be adequate for the foreseeable future.

Under the Expanded Operations Alternative, increased operations at LANL, combined with projected growth in the rest of Los Alamos County, could exceed Los Alamos County's rights to withdraw water from the regional aquifer. In recent years, combined LANL and county water demands have consumed between 80 and 90 percent of the currently developed water rights. Nevertheless, LANL projections would still remain within its annual water use ceiling quantity (542 million gallons [2,050 million liters]) under this alternative. As discussed under the No Action Alternative (see Section 5.8.2.1) and detailed in Section 4.8.2.3, supplementing the Los Alamos water supply system with San Juan-Chama water will be essential to ensuring that the region has adequate water supplies under this alternative and in the future.

Technical Area Impacts

Construction and related DD&D requirements for utility infrastructure resources including electricity, fuels, and water are expected to be negligible to minor for most actions including for the Center for Weapons Programs Research and Replacement Office Buildings in TA-3, and for the TA-21 structure DD&D project. Implementation of the TA-21 Structure DD&D project, which would include the natural-gas fired TA-21 steam plant, would also have a negligible to minor reduction in LANL natural gas consumption as the plant's natural gas demand was historically less than 10 percent of site-wide demand.

Key Facilities Impacts

A number of project actions would be undertaken as part of this alternative that would result in enhancement of operational capabilities of Key Facilities and a net increase in infrastructure resource demands to support the increased level of operations. Specifically, the Metropolis Center Increase in Level of Operations and LANSCE Refurbishment projects would result in a minor to moderate increase in LANL infrastructure resource requirements and within the region of influence to support higher levels of operations. Increased pit production at TA-55 under this alternative would entail a relatively minor increase in LANL infrastructure requirements because

existing Plutonium Facility Complex operations currently constitute a relatively small percentage of LANL's total demands.

5.9 Waste Management

Waste management impacts are evaluated based on the quantities of waste generated by Key Facilities, non-Key Facilities and LANL's environmental restoration projects. Waste generation rates are used to measure the impacts on the LANL waste management infrastructure and local environment. Other impacts associated with waste management are addressed in the following sections: Air Quality (see Section 5.4); Worker Health (see Section 5.6.3); Transportation (see Section 5.10); and Facility Accidents (see Section 5.12). Waste management practices related to handling, treating, storing, and preparing for transport and disposal are described in Chapter 3 of this SWEIS.

Waste quantities are compiled by waste type and include process wastewaters (sanitary liquid waste, high explosives contaminated liquid waste, and industrial effluents); solid waste, and radioactive (including radioactive liquid waste) and chemical wastes. Due to the large number of construction and demolition projects now underway or planned at LANL, the additional categories of construction waste and DD&D waste have been included in the impacts analysis. LANL's environmental restoration project wastes are presented as a separate category.

The impacts associated with waste management were evaluated in the *1999 SWEIS*, based on the historical waste generation rates, projections of future waste generation, and the infrastructure in place to manage the wastes. With the exception of liquid wastes, solid (sanitary) wastes, and low-level radioactive waste, all LANL wastes are disposed offsite.

In this analysis, the *1999 SWEIS* projections were reviewed, and adjusted as needed, to present bounding values of waste quantities associated with each alternative. As discussed in Section 4.9, the *1999 SWEIS* projections adequately covered waste generated through facility operations; exceedances were the result of one-time events such as chemical cleanouts, maintenance, remediation activities, and cleanup following the Cerro Grande Fire.

In addition to the waste generated onsite by LANL activities, LANL has historically received small quantities of low-level radioactive and transuranic waste from offsite locations. Some of these wastes are generated by LANL activities at other locations and some are generated by other DOE facilities that do not have the capability to manage the wastes. Receipt of these wastes by LANL is expected to continue at the historical rate of 5 to 10 waste shipments per year. The quantities of offsite waste expected are small compared to the onsite waste generated and would be easily accommodated by the existing LANL waste management infrastructure.

In the sections that follow, waste generation rates for each facility are evaluated for the three alternatives. Bounding waste generation rates are projected for the No Action Alternative, considering the actions covered by the *1999 SWEIS* and any subsequent actions that have received independent NEPA analysis. Under the Reduced Operations Alternative, waste projections were selectively reduced to correspond to a lower level of operations. For the Expanded Operations Alternative, planned additional activities were considered and waste

projections were increased, as necessary, to adequately bound the impacts. **Table 5–37** summarizes the waste management impacts associated with each of the alternatives.

Table 5–37 Summary of Total (Operations, Decontamination, Decommissioning, and Demolition, and Remediation) Waste Generation Projections by Alternative (Cumulative 2007 through 2016)

Waste Type	*No Action Alternative*	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Low-Level Radioactive Waste [a, b]			
Bulk low-level radioactive waste (cubic yards)	38,000	38,000	194,000 to 881,000
Packaged low-level radioactive waste (cubic yards)	33,000 to 118,000	33,000 to 99,000	81,000 to 173,000
High activity low-level radioactive waste (cubic yards)	–	–	0 to 347,000
Remote-handled low-level radioactive waste (cubic yards)	–	–	470 to 1,700
Mixed low-level radioactive waste (cubic yards)	1,800 to 2,700	1,800 to 2,700	4,000 to 183,000
Transuranic Waste			
Contact-handled (cubic yards) [a]	3,500 to 5,900	3,500 to 5,900	5,400 to 33,000
Remote-handled (cubic yards)	–	–	12 to 62
Construction and demolition debris [c] (cubic yards)	197,000	197,000	656,000 to 736,000
Chemical waste [d] (pounds)	19,000,000 to 37,000,000	19,000,000 to 37,000,000	65,000,000 to 129,000,000
Liquid Radioactive Waste			
Liquid transuranic waste (gallons per year)	30,000	30,000	50,000
Liquid low-level radioactive waste (at TA-50) (gallons per year)	4,000,000	4,000,000	5,000,000
Liquid low-level radioactive waste (at TA-53) (gallons per year)	140,000	5,000 [e]	140,000

TA = technical area.

[a] Operations waste volumes are assumed to be contact-handled transuranic waste and packaged low-level radioactive waste, although small volumes of other types could be generated.

[b] The subcategories of low-level radioactive waste do not necessarily meet precise definitions, but are used to assist in the analysis of disposal and transportation options and impacts.
- Bulk low-level radioactive waste = wastes that can be transported in large volumes in soft-sided containers.
- Packaged low-level radioactive waste = typical low-level radioactive waste packaged in drums or boxes.
- High activity low-level radioactive waste = waste exceeding 10 CFR 61.55 Class A concentrations (greater than 10 nanocuries per gram of transuranic nuclides) and therefore not accepted at certain facilities.
- Remote-handled low-level radioactive waste = waste with a dose rate exceeding 200 millirem per hour at the surface of the container.

[c] Construction and demolition debris includes uncontaminated wastes such as steel, brick, concrete, pipe and vegetative matter from land clearing.

[d] Chemical waste includes wastes regulated under Resource Conservation and Recovery Act, Toxic Substance Control Act, or state hazardous waste regulations.

[e] Under the Reduced Operations Alternative, operations at LANSCE would cease. Approximately 5,000 gallons (20,000 liters) of radioactive liquid waste per year from TA-50 would continue to be treated at TA-53.

Note: To convert cubic yards to cubic meters, multiply by 0.76456; gallons to liters, multiply by 3.78533; pounds to kilograms, multiply by 0.45359. Values have been rounded to the nearest hundred, thousand, or million.

5.9.1 No Action Alternative

Los Alamos National Laboratory Site-Wide Impacts

The types and quantities of wastes expected to be generated by LANL operations under the No Action Alternative are generally the same as those presented in the *1999 SWEIS* for the Expanded Operations Alternative as modified for a lower level of pit production.

Wastewaters are collected and managed in systems designed for each specific category of wastewater – sanitary liquid waste, high explosives-contaminated liquid waste, and industrial effluent. Sanitary wastes from across the LANL facility are delivered by dedicated pipeline to the Sanitary Wastewater System Plant at TA-46. The Sanitary Wastewater System Plant design capacity of 600,000 gallons (2.3 million liters) per day (DOE 1999a) is expected to be adequate for demand under the No Action Alternative. The treated wastewater is pumped to TA-3 to be recycled in the Steam Plant cooling towers or discharged into Outfall 001. Reuse of treated sanitary wastewater is expected to continue. Sludge from the treatment of sanitary wastewater will continue to be disposed offsite as a New Mexico special waste. Offsite disposal capacity is expected to be adequate. (See Section 4.9.1 for more details on sanitary wastewater treatment.)

Wastewaters containing high explosives compounds are generated by high explosives testing and processing activities. The High Explosives Wastewater Treatment Facility, located in TA-16, treats process waters containing high explosives compounds. Under the No Action Alternative, the High Explosives Wastewater Treatment Facility is expected to continue to operate within the 170,000-gallon (644,000-liter) projection for annual discharges included in the *1999 SWEIS* (DOE 1999a). (See Section 4.9.1.3 for additional discussion of high explosives treatment.)

Industrial effluent is discharged to a number of NPDES-permitted outfalls across LANL. Currently, LANL facilities discharge wastewater to a total of 21 outfalls, down from the 55 identified in the *1999 SWEIS* (LANL 2005j). LANL's projected industrial effluent discharges would be approximately 280 million gallons (1.1 billion liters) per year under the No Action Alternative (see Section 5.3.1). (See Section 4.9.1.4 for more details on industrial effluents.)

Sanitary waste generated at LANL will be managed at a transfer station, where solid waste is sorted and consolidated for transport to an offsite landfill (LANL 2005a, 2006). LANL conducts an aggressive waste minimization and recycling program, greatly reducing the amount of sanitary waste requiring disposal (LANL 2004p). Sanitary solid waste includes both routine and nonroutine wastes. Routine waste is waste produced from any type of periodic or recurring work that is considered ongoing in nature, including production operations; analytical, and/or research and development laboratory operations; and treatment, storage, and disposal facility operations. Under the No Action Alternative, routine sanitary waste quantities are expected to be bounded at 5,000 tons (4,500 metric tons) per year.

Nonroutine waste is defined as one-time operations waste, including waste produced from construction, environmental restoration, and DD&D activities (LANL 2003d). Nonroutine waste quantities are projected for construction, DD&D and LANL's environmental restoration project wastes in the sections that follow. Under the No Action Alternative, three major construction projects would be undertaken that would generate significant quantities of construction wastes.

The projects are TA-16 Refurbishment, CMR Building Replacement, and Consolidation of Certain Dynamic Experimentation Activities. Construction wastes associated with these projects are expected to total about 12,000 cubic yards (9,200 cubic meters) (DOE 2002k, 2003f, 2003g). Generally, construction wastes may be disposed in a solid waste landfill or a construction and demolition debris landfill; offsite disposal capacity is expected to be adequate.

Under the No Action Alternative, DD&D wastes would be generated through six projects, as detailed in **Table 5–38**. Although large quantities of demolition debris and low-level radioactive waste could be generated under this alternative, most wastes could be disposed offsite and offsite capacity is expected to be sufficient. The Chemistry and Metallurgy Research Building Replacement Project phase for DD&D would likely not occur until after 2015, after the new building was operational. Waste generated by the demolition process for that structure would likely involve both onsite and offsite disposal practices.

Table 5–38 Wastes from Decontamination, Decommissioning, and Demolition Activities – No Action Alternative (cubic yards)

Decontamination, Decommissioning, and Demolition Project	*Bulk Low-Level Radioactive Waste*	*Packaged Low-Level Radioactive Waste*	*Mixed Low-Level Radioactive Waste*	*Demolition Debris*	*Chemical Waste* [a] *(pounds)*
TA-16	8	2	–	5,800	51,000
Los Alamos Site Office	–	–	–	10,000	486,000
General Excess Facilities	13,400	4,500	25	128,000	334,000
Dynamic Experimentation [b]	–	20	–	21,000	781,000
Chemistry and Metallurgy Research [c]	12,000	4,000	280	20,000	280,000
LANSCE Area A [d]	4,000	–	89	520	3,000
Total [e]	29,000	8,500	390	185,000	1,935,000

TA = technical area, LANSCE = Los Alamos Neutron Science Center.
[a] Chemical waste includes Resource Conservation and Recovery Act (RCRA) hazardous waste and Toxic Substances Control Act (TSCA) waste (asbestos).
[b] Values from Dynamic Experimentation EA (DOE 2003g).
[c] Values from the *Chemistry and Metallurgy Research Building Replacement EIS* (DOE 2003f) and Preliminary Chemistry and Metallurgy Research Building Disposition Study (LANL 2003a).
[d] Values from the *1999 SWEIS* (DOE 1999a) and National Environmental Policy Act Review LAN-05-018 (LANL 2006).
[e] Totals may not add due to rounding.
Note: To convert cubic yards to cubic meters, multiply by 0.76456.

Wastes generated by LANL's environmental restoration projects are presented separately from operational wastes. These nonroutine waste quantities could vary widely from year to year, and differ significantly from projections due to actual site-specific conditions encountered during field activities. Low-level radioactive waste generated by LANL's environmental restoration projects could be disposed onsite at TA-54 Area G or offsite at a commercial or DOE disposal facility. Chemical waste quantities generated by LANL's environmental restoration projects are expected to be substantial (LANL 2004i). Offsite capacity for all waste types is expected to be sufficient.

The expected impacts of waste generation are presented below for each category of chemical and radioactive waste. Projections of chemical and radioactive waste quantities are presented in **Table 5–39**. Information presented is based on the *1999 SWEIS* projections updated with

information from the *Waste Volume Forecast*, prepared in June 2003 (LANL 2003d) and updated in September 2004 (LANL 2004i). The *Forecasts* integrate historical generation data with near- and long-term program plans (LANL 2003d). To aid the analysis, waste categories were further characterized as routine or non-routine.

Table 5–39 Radioactive and Chemical Waste Projections from Routine Operations – No Action Alternative

Key and Non-Key Facilities	*Waste Projections (cubic yards per year)* [a]			
	Low-Level Radioactive Waste	*Mixed Low-Level Radioactive Waste*	*Transuranic Waste*	*Chemical Waste (pounds per year)*
Chemistry and Metallurgy Research [b]	2,400 [b]	25	55 [b]	24,000
Sigma Complex	1,300	5	0	22,000
Machine Shops	790	0	0	1,045,000
Materials Science Laboratory	0	0	0	1,300
Metropolis Center [c]	0	0	0	0
High Explosives Processing Facility	20	<1	0	28,000
High Explosives Testing Facility	1,200	1	<1	78,000
Tritium Facility	630	4	0	3,800
Pajarito Site	190	2	0	8,800
Target Fabrication Facility	13	<1	0	8,400
Bioscience Facilities	45	4	0	29,000
Radiochemistry Facility	350	5	0	7,300
Radioactive Liquid Waste Treatment Facility [d]	330	3	13	880
Los Alamos Neutron Science Center	1,400	1	0	37,000
Solid Radioactive and Chemical Waste Facilities [e]	300 [f]	10 [f]	35	2,000
Plutonium Facility Complex	990	20	440	19,000
Non-Key Facilities	1,000 [g]	40	30 [g]	1,435,000
TOTAL [h]	11,000	120	570	2,749,000

[a] Projected values from *1999 SWEIS* Record of Decision, as documented in the *2004 SWEIS Yearbook* (LANL 2005g), unless otherwise noted. Projections are based upon expected, routine facility operations and do not include wastes from non-routine events such as chemical cleanouts and construction projects.
[b] Values reflect a pit production level of 20 pits per year.
[c] Value not projected in *1999 SWEIS* Record of Decision. Metropolis Center was not a designated Key Facility at that time.
[d] Values adjusted from *1999 SWEIS* projections based on historical generation rates and new projections (LANL 2006).
[e] This Key Facility includes the Legacy Transuranic Waste Retrieval Program and the Offsite Source Recovery Program.
[f] Value adjusted upward from *1999 SWEIS* Record of Decision projection based on projections in the 2004 revision to the *Waste Volume Forecast*. (LANL 2004i).
[g] Value adjusted upward from *1999 SWEIS* projection based on historical generation rates and projections in the 2004 revision to the *Waste Volume Forecast* (LANL 2004i).
[h] Totals may not add due to rounding.
Note: To convert pounds to kilograms, multiply by 0.45359; cubic yards to cubic meters, multiply by 0.76456. Values have been rounded to the nearest hundred, thousand, or million.

Low-Level Radioactive Wastes—Routine low-level radioactive waste generation has been trending downward (LANL 2003d) and is expected to continue in this direction under the No Action Alternative. Some fluctuations in facility-specific generation rates are expected. For example, the High Explosives Testing Key Facility, due to increased numbers of hydrotests and the use of a foam matrix for waste containment, is projected to double its average low-level

radioactive waste generation (LANL 2004i). In addition, relocating the actinide processing and recovery capability to the Chemistry and Metallurgy Research Building may increase low-level radioactive waste quantities by up to 24 cubic yards (18 cubic meters) per year (DOE 2003f). Table 5–39 presents the projected annual low-level radioactive waste quantities from routine operations at Key and Non-Key Facilities. The TA-54 Area G expansion into Zone 4 is designed to provide 40 years of disposal capacity for operational low-level radioactive waste, assuming a disposal rate of about 3,900 cubic yards (3,000 cubic meters) per year. In addition, offsite disposal capacity is available and, together with onsite capacity, is expected to be adequate for wastes generated under the No Action Alternative.

Mixed Low-Level Radioactive Wastes—The pattern for mixed low-level radioactive waste generation is similar to that for low-level radioactive waste, with routine generation trending downward and LANL's environmental restoration project-generated quantities varying widely (LANL 2004i). Table 5–39 presents the projected annual mixed low-level radioactive waste quantities from routine operations at Key and Non-Key Facilities.

Transuranic and Mixed Transuranic Wastes—In the Waste Volume Forecast, transuranic and mixed transuranic categories have been combined for discussion; both categories of waste are managed for ultimate disposal at WIPP. Higher generation rates, up to about 1600 cubic yards (1,200 cubic meters) per year LANL-wide, are projected for the short term (2005 through 2007), primarily due to activities under the Legacy Transuranic Waste Retrieval Program and several nuclear materials programs (LANL 2004i). The Nuclear Materials Technology vault cleanout would contribute nonroutine transuranic wastes for the short term. Pit production activities (up to 20 pits per year) are expected to yield additional quantities of transuranic and mixed transuranic wastes at the Plutonium Facility Complex. Relocating the actinide processing and recovery capability to the Chemistry and Metallurgy Research Building may increase transuranic waste quantities by 8 cubic yards (6.1 cubic meters) per year (DOE 2003f). After 2007, most transuranic wastes would be generated through routine activities (LANL 2003d). The capacity of WIPP allocated to LANL newly-generated transuranic waste is about 14,000 cubic yards (10,800 cubic meters) (DOE 2002f), which is expected to be adequate for wastes generated under the No Action Alternative. Table 5–39 presents the projected annual transuranic quantities from routine operations at Key and Non-Key Facilities.

Chemical Wastes—Routine chemical waste generation has been trending downward (LANL 2003d) and is expected to continue in this direction under the No Action Alternative. Bulk chemical wastes generated by LANL's environmental restoration projects and operational waste generation comprise approximately 90 percent of the chemical and hazardous waste generated across LANL (LANL 2003d). Although LANL's environmental restoration project quantities are highly variable, operational bulk chemical waste is generated primarily at the Sanitary Wastewater Systems Plant and quantities are steady. Nonbulk chemical and hazardous wastes are generated by a wide range of operations at LANL (LANL 2004i). Approximately half of the nonbulk chemical waste is not regulated as hazardous by the State, but does not meet waste acceptance criteria for disposal at a solid waste landfill (LANL 2003d). Rates of generation for nonbulk chemical and hazardous wastes from operations are expected to remain steady under the No Action Alternative (LANL 2003d). Scheduled cleanouts of outdated or unused chemicals periodically could increase annual quantities for specific facilities

(LANL 2004i). Table 5–39 presents the projected annual chemical waste quantities from routine operations at Key and Non-Key Facilities.

Radioactive Liquid Waste Treated at LANL—Radioactive liquid waste is treated at three locations, TA-21, TA-50 and TA-53. Treatment at TA-21 would continue only until all DD&D activities at this technical area are complete. The RLWTF at TA-50 continues to treat the majority of radioactive liquid wastes generated at LANL. Treated radioactive liquid waste quantities at the RLWTF, including acid and caustic radioactive liquid waste treated in Room 60, are projected in **Table 5–40**. Increased hydrotesting at the High Explosives Testing Facility is expected to generate additional radioactive liquid waste, up to 66,000 gallons (250,000 liters) annually to be treated at the RLWTF, but quantities are well within projected treatment volumes. Quantities of radioactive liquid wastes at TA-53 are also included in Table 5–40.

Table 5–40 Radioactive Liquid Waste Treated at Los Alamos National Laboratory – No Action Alternative

Waste Treatment Activity	*Projection*
Pretreatment of radioactive liquid waste at TA-21	– [a]
Pretreatment of transuranic liquid waste from TA-55 in Room 60	30,000 gallons (110,000 liters) per year
Solidification of transuranic sludge at TA-50	16 yards^3 (12 meters^3) per year
Radioactive liquid waste treated at TA-50	4,000,000 gallons (15,000,000 liters) per year
Secondary treatment of radioactive liquid waste at TA-50	260,000 gallons (1,000,000 liters) per year
De-water low-level radioactive waste sludge at TA-50	70 yards^3 (50 meters^3) per year
Radioactive liquid waste treated at TA-53	140,000 gallons (520,000 liters) per year [b]
Transport evaporator bottoms to Tennessee	66,000 gallons (250,000 liters) per year
Receive solidified evaporator bottoms from Tennessee [c]	25 yards^3 (20 meters^3) per year

TA = technical area.
[a] No new radioactive liquid waste is being generated at TA-21, and all inventory that exists in tanks and equipment is expected to be processed by 2007.
[b] Radioactive liquid waste treated at TA-53 includes waste volumes from LANSCE plus approximately 5,000 gallons (20,000 liters) per year from TA-50.
[c] This is solid low-level radioactive waste that is disposed of at TA-54.
Source: LANL 2006.

Summary—Waste management impacts from LANL operations under the No Action Alternative are expected to remain within the capacity of the LANL waste management infrastructure. **Table 5–41** includes a summary of waste quantities estimated for operations, DD&D, and LANL's environmental restoration project activities under the No Action Alternative. Although the summary table provides waste projections only through 2016, impacts from operations are expected to continue at comparable rates for the longer term. For operational waste, waste projections are presented as a range, with the lower end of the range representing the quantity projected in the Waste Volume Forecast (LANL 2004i) and the upper end representing the *1999 SWEIS* projection, except as noted. For this summary table, the transuranic and low-level radioactive waste categories have been further subdivided (contact- and remote-handled transuranic) to facilitate identification of offsite disposal options and analysis of transportation impacts.

Most wastes, with the exception of some low-level radioactive waste, are disposed offsite at permitted facilities designed for specific categories of wastes. The expansion of TA-54 Area G

into Zone 4 is expected to provide onsite low-level radioactive waste disposal capacity for operations waste through the 2016 timeframe and beyond. Because of the difficulties in accurately predicting LANL's environmental restoration project-generated wastes, some variances from projections are possible in future years. The waste management infrastructure at LANL is adequate, in terms of staffing and facilities, to manage the quantities of waste expected to be generated under the No Action Alternative.

Table 5–41 Summary of Waste Types by Generator Category – No Action Alternative (Cumulative 2007 through 2016) (in cubic yards)

Waste Type	*Operational Waste* [a]	*DD&D Waste* [b]	*Remediation Waste* [c]	*Total*
Low-Level Radioactive Waste [d]				
Bulk low-level radioactive waste	-	29,000	8,800	38,000
Packaged low-level radioactive waste	25,000 to 110,000	8,500	–	33,000 to 118,000
High Activity low-level radioactive waste	–	–	–	–
Remote-handled low-level radioactive waste	–	–	–	–
Mixed Low-Level Radioactive Waste	270 to 1,200	390	1,100	1,800 to 2,700
Transuranic Waste				
Contact-handled	3,300 to 5,700	0	210	3,500 to 5,900
Remote-handled	–	–	–	–
Construction and Demolition Debris [e]	12,000 [f]	185,000	–	197,000
Chemical Waste [g] **(pounds)**	9,997,000 to 27,000,000	1,935,000	7,513,000	19,000,000 to 37,000,000

DD&D = decontamination, decommissioning, and demolition.

[a] Operations waste volumes are represented as a range, with the lower end represented by best-estimate values documented in the Waste Volume Forecasts (LANL 2003d, 2004i), and the upper end represented by the bounding *1999 SWEIS* projections (DOE 1999a), adjusted as detailed in Table 5–39. These wastes are assumed to be contact-handled transuranic waste and packaged low-level radioactive waste, although small volumes of other types could be generated.

[b] DD&D waste quantities were estimated for the following projects: TA-16 Refurbishment, Los Alamos Site Office Building Replacement, General Excess Facilities, Chemistry and Metallurgy Research Building Replacement, LANSCE Area A Renovation, and Consolidation of Certain Dynamic Experimentation Activities.

[c] Details of LANL's environmental restoration activities and resulting wastes are provided in Appendix I. A remediation decision is pending from NMED on remediation of MDA H. If it were to be removed, an additional 600 cubic yards of chemical waste and 4,800 cubic yards of bulk low-level radioactive waste would be generated.

[d] The subcategories of low-level radioactive waste do not necessarily meet precise definitions, but are used to assist in the analysis of disposal and transportation options and impacts.
- Bulk low-level radioactive waste = wastes that can be transported in large volumes in soft-sided containers.
- Packaged low-level radioactive waste = typical low-level radioactive waste packaged in drums or boxes.
- High activity low-level radioactive waste = waste exceeding 10 CFR 61.55 Class A concentrations (greater than 10 nanocuries per gram of transuranic nuclides) and therefore not accepted at certain facilities.
- Remote-handled low-level radioactive waste = waste with a dose rate exceeding 200 millirem per hour at the surface of the container.

[e] Construction and demolition debris includes uncontaminated wastes such as steel, brick, concrete, pipe and vegetative matter from land clearing.

[f] Construction debris quantities were estimated for the following projects: TA-16 Refurbishment, Chemistry and Metallurgy Research Building Replacement, and Consolidation of Certain Dynamic Experimentation Activities.

[g] Chemical waste includes wastes regulated under Resource Conservation and Recovery Act, Toxic Substance Control Act, or state hazardous waste regulations.

Note: To convert cubic yards to cubic meters, multiply by 0.76456; pounds to kilograms, multiply by 0.45359. Values have been rounded to the nearest hundred, thousand, or million.

5.9.2 Reduced Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Many of the waste management impacts under the Reduced Operations Alternative would be the same as those under the No Action Alternative. Wastewaters, including sanitary liquid waste, high explosives-contaminated liquid waste, and industrial effluent, would be collected and managed in systems designed for each category of waste. High explosive-contaminated waste quantities would be reduced by about 20 percent as operations are scaled back at the High Explosives-Processing and Testing Facilities. Sanitary waste generated at LANL would be managed at a transfer station, where solid waste is sorted and consolidated for transport to an offsite landfill (LANL 2005a). As discussed under the No Action Alternative, waste minimization and recycling activities would reduce the quantities of solid waste disposed. Waste management impacts associated with DD&D activities would be the same as those of the No Action Alternative.

Under the Reduced Operations Alternative, smaller quantities of some radioactive and chemical wastes would be generated due to the shut down of the Pajarito Site and LANSCE, and reductions in high explosives processing and testing. Projections of chemical and radioactive waste quantities from routine operations at Key and Non-Key Facilities are presented in **Table 5–42**.

Radioactive liquid waste treatment would be the same as under the No Action Alternative, with the exception of limited treatment at TA-53 as LANSCE operations are halted; some liquid wastes with high tritium content from TA-50 could continue to be processed at TA-53. Radioactive liquid waste treatment quantities are presented in **Table 5–43**.

Summary—Waste management impacts from LANL operations under the Reduced Operations Alternative are expected to be similar to those under the No Action Alternative, with some reductions in waste quantities due to the closure of LANSCE and the Pajarito Site and reduced operational levels at the High Explosives Facilities. **Table 5–44** includes a summary of waste quantities estimated for operations, DD&D, and LANL's environmental restoration projects under the Reduced Operations Alternative. Although the summary table provides waste projections only through 2016, impacts from operations are expected to continue at comparable rates for the longer term. For operational waste, waste projections are presented as a range, with the lower end of the range representing the quantity projected in the Waste Volume Forecast (LANL 2004i) and the upper end representing the *1999 SWEIS* projection, except as noted. The waste management infrastructure at LANL is adequate, in terms of staffing and facilities, to manage the quantities of waste expected to be generated under the Reduced Operations Alternative.

Table 5–42 Radioactive and Chemical Waste Projections from Routine Operations – Reduced Operations Alternative

Key and Non-Key Facilities	Waste Projections (cubic yards per year) [a]			
	Low-Level Radioactive Waste	Mixed Low-Level Radioactive Waste	Transuranic Waste	Chemical Waste (pounds per year)
Chemistry and Metallurgy Research [b]	2,400	25	55	24,000
Sigma Complex	1,300	5	0	22,000
Machine Shops	790	0	0	1,045,000
Materials Science Laboratory	0	0	0	1,300
Metropolis Center [c]	0	0	0	0
High Explosives Processing Facility	15 [d]	<1 [d]	0	23,000 [d]
High Explosives Testing Facility	980 [d]	1 [d]	<1 [d]	62,000 [d]
Tritium Facility	630	4	0	3,800
Pajarito Site [e]	0	0	0	0
Target Fabrication Facility	13	<1	0	8,400
Bioscience Facilities	45	4	0	29,000
Radiochemistry Facility	350	5	0	7,300
Radioactive Liquid Waste Treatment Facility [f]	330	3	13	880
Los Alamos Neutron Science Center [g]	5	1	0	0
Solid Radioactive and Chemical Waste Facilities [h]	300 [i]	10 [i]	35	2,000
Plutonium Facility Complex	990	20	440	19,000
Non-Key Facilities	1,000 [j]	40	30 [j]	1,435,000
Total [k]	9,100	120	570	2,682,000

[a] Projected values from *1999 SWEIS* Record of Decision, as documented in the *2004 SWEIS Yearbook* (LANL 2005g), unless otherwise noted. Projections are based upon expected, routine facility operations and do not include wastes from non-routine events such as chemical cleanouts and construction projects.

[b] Values reflect a pit production level of 20 pits per year.

[c] Value not projected in *1999 SWEIS* Record of Decision. The Metropolis Center was not a designated Key Facility at that time.

[d] A 20 percent reduction from No Action levels is projected, based on a 20 percent reduction in operations.

[e] No wastes would be generated at TA-18 as activities are ceased.

[f] Values adjusted from *1999 SWEIS* projections based on historical generation rates and new projections (LANL 2006).

[g] Only small quantities of waste would be generated as LANSCE operations are halted and the facility is maintained in standby mode.

[h] This Key Facility includes the Legacy Transuranic Waste Retrieval Program and the Offsite Source Recovery Program.

[i] Value adjusted upward from *1999 SWEIS* Record of Decision projection based on projections in the 2004 revisions to the *Waste Volume Forecast* (LANL 2004i).

[j] Value adjusted upward from *1999 SWEIS* projection based on historical generation rates and projections in the 2004 revisions to the *Waste Volume Forecast* (LANL 2004i).

[k] Totals may not add due to rounding. Values have been rounded to the nearest hundred, thousand, or million.

Note: To convert cubic yards to cubic meters, multiply by 0.76456; pounds to kilograms, multiply by 0.45359.

Table 5–43 Radioactive Liquid Waste Treated at Los Alamos National Laboratory – Reduced Operations Alternative

Waste Treatment Activity	*Projection*
Pretreatment of radioactive liquid waste at TA-21	– [a]
Pretreatment of transuranic liquid waste from TA-55 in Room 60	30,000 gallons (110,000 liters)/year
Solidification of transuranic sludge at TA-50	16 yards^3 (12 meters^3)/year
Radioactive liquid waste treated at TA-50	4,000,000 gallons (15,000,000 liters)/year
Secondary treatment of radioactive liquid waste at TA-50	260,000 gallons (1,000,000 liters)/year
De-water low-level radioactive waste sludge at TA-50	70 yards^3 (50 meters^3)/year
Radioactive liquid waste treated at TA-53	5,000 gallons (20,000 liters)/year [b]
Transport evaporator bottoms to Tennessee	66,000 gallons (250,000 liters)/year
Receive solidified evaporator bottoms from Tennessee [c]	25 yards^3 (20 meters^3)/year

TA = technical area.
[a] No new radioactive liquid waste is being generated at TA-21, and all inventory that exists in tanks and equipment is expected to be processed by 2007.
[b] Under the Reduced Operations Alternative, operations at the LANSCE facility will cease. Approximately 5,000 gallons (20,000 liters) of radioactive liquid waste per year from TA-50 will continue to be treated at TA-53.
[c] This is solid low-level radioactive waste that is disposed of at TA-54.
Source: LANL 2006.

5.9.3 Expanded Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Many of the waste management impacts under the Expanded Operations Alternative would be the same as under the No Action Alternative although certain waste volumes would periodically increase. Wastewaters, including sanitary liquid waste, high explosives-contaminated liquid waste, and industrial effluent, would be collected and managed in systems designed for each category of waste. Sanitary waste generated at LANL would be managed at a transfer station, where solid waste is sorted and consolidated for transport to an offsite landfill (LANL 2005a). Waste minimization and recycling activities would reduce quantities of solid waste disposed.

Waste management impacts associated with DD&D activities would increase under the Expanded Operations Alternative, as detailed in **Table 5–45**. Large quantities of demolition debris and bulk low-level radioactive waste wastes are expected from DD&D actions, along with smaller quantities of transuranic, mixed low-level radioactive waste, sanitary, asbestos, and hazardous wastes. Most of the waste would be disposed offsite. Demolition debris may be sent to any solid waste landfill permitted to accept such debris. Low-level radioactive waste may be disposed at TA-54 Area G or sent offsite to DOE or commercial facilities. Additional construction waste would be generated as new facilities are constructed under this alternative. **Table 5–46** summarizes the quantities of construction wastes associated with major new construction under the Expanded Operations Alternative.

Table 5–44 Summary of Waste Types by Generator Category – Reduced Operations Alternative (Cumulative 2007 through 2016) (in cubic yards)

Waste Type	*Operational Waste* [a]	*DD&D Waste* [b]	*Remediation Waste* [c]	*Total*
Transuranic Waste				
Contact-handled	3,300 to 5,700	–	210	3,500 to 5,900
Remote-handled	–	–	–	–
Low-Level Radioactive Waste [d]				
Bulk low-level radioactive waste	–	29,000	8,800	38,000
Packaged low-level radioactive waste	25,000 to 91,000	8,500	–	33,000 to 99,000
High activity low-level radioactive waste	–	–	–	–
Remote-handled low-level radioactive waste	–	–	–	–
Mixed Low-Level Radioactive Waste	270 to 1,200	390	1,100	1,800 to 2,700
Construction and Demolition Debris [e]	12,000 [f]	185,000	–	197,000
Chemical Waste [g] **(pounds)**	9,997,000 to 27,000,000	1,935,000	7,513,000	19,000,000 to 36,000,000

DD&D = decontamination, decommissioning, and demolition.

[a] Operations waste volumes are represented as a range, with the lower end represented by best-estimate values documented in the Waste Volume Forecasts (LANL 2003d, 2004i), and the upper end represented by the bounding *1999 SWEIS* projections (DOE 1999a), adjusted as detailed in Table 5–42. These wastes are assumed to be contact-handled transuranic waste and packaged low-level radioactive waste, although small volumes of other types could be generated.

[b] DD&D waste quantities are the same as under the No Action Alternative.

[c] LANL's environmental restoration project-related waste quantities are the same as under the No Action Alternative. These waste estimates do not include an additional 600 cubic yards of chemical waste and 4,800 cubic yards of bulk low-level radioactive waste may be generated by a removal action.

[d] The subcategories of low-level radioactive waste do not necessarily meet precise definitions, but are used to assist in the analysis of disposal and transportation options and impacts.
- Bulk low-level radioactive waste = wastes that can be transported in large volumes in soft-sided containers.
- Packaged low-level radioactive waste = typical low-level radioactive waste packaged in drums or boxes.
- High activity low-level radioactive waste = waste exceeding 10 CFR 61.55 Class A concentrations (greater than 10 nanocuries per gram of transuranic nuclides) and therefore not accepted at certain facilities.
- Remote-handled low-level radioactive waste = waste with a dose rate exceeding 200 millirem per hour at the surface of the container.

[e] Construction and demolition debris includes uncontaminated wastes such as steel, brick, concrete, pipe and vegetative matter from land clearing.

[f] Construction debris quantities are the same as under the No Action Alternative.

[g] Chemical waste includes wastes regulated under RCRA, TSCA, or state hazardous waste regulations.

Note: To convert cubic yards to cubic meters, multiply by 0.76456; pounds to kilograms, multiply by 0.45359. Values have been rounded to the nearest hundred, thousand, or million.

Table 5–45 Wastes from Decontamination, Decommissioning, and Demolition Activities – Expanded Operations Alternative (cubic yards)

DD&D Project	*Transuranic Waste*	*Bulk Low-Level Radioactive Waste*	*Packaged Low-Level Radioactive Waste*	*Mixed Low-Level Radioactive Waste*	*Demolition Debris*	*Chemical Waste [a] (pounds)*
No Action Total [b]	–	29,000	8,500	390	185,000	1,935,000
Center for Weapons Physics Research	–	13,000	4,300	–	187,000	313,000
Replacement Office Buildings	–	23	8	–	6,900	–
Radiological Sciences Institute	1,100 [c]	70,000	23,000 [c]	1,000	74,000	1,304,000
Radioactive Liquid Waste Treatment Facility Upgrade[d]	300	8,500	2,800	220	1,800	212,000
TA-55 Radiography Facility	–	–	–	–	7,900	–
Plutonium Refurbishment	340	970	320	220	2,100	2,000
TA-18 Closure	–	3,500	1,200	5	17,000	90,000
TA-21 Structure	1	26,000	8,700	65	48,000	440,000
Waste Management Facilities Transition	–	23,000	7,500	8	53,000	591,000
Total [e]	1,800	174,000	56,000	1,900	584,000	4,883,000

DD&D = decontamination, decommissioning, and demolition; RCRA = Resource Conservation and Recovery Act; TSCA = Toxic Substances Control Act.

[a] Chemical waste includes RCRA hazardous waste and TSCA waste (asbestos).

[b] Details of the DD&D waste volumes generated under the No Action Alternative are provided in Table 5–38.

[c] In addition, DD&D associated with the Radiological Sciences Institute is expected to generate 467 cubic yards of remote-handled low-level radioactive waste and 12 cubic yards of remote-handled transuranic waste.

[d] Waste volumes reflect the option that generates the most waste.

[e] Totals may not add due to rounding.

Note: To convert cubic yards to cubic meters, multiply by 0.76456. Values have been rounded to the nearest hundred, thousand, or million.

The type and extent of environmental restoration activities that would be required by NMED are not yet well-defined. To assess impacts under this uncertain scope, LANL's MDA remediation activities were analyzed under two scenarios, the Capping Option and the Removal Option. The waste management impacts associated with both scenarios are presented here.

MDA remediation wastes would be generated under the Capping Option, with substantial quantities of demolition and low-level radioactive waste expected. Variations in actual versus projected waste quantities are anticipated for these wastes due to the difficulty in predicting selected remedies and waste types and quantities.

Table 5–46 Construction Wastes [a] – Expanded Operations Alternative

Construction Project	*Waste Generated (cubic yards)*
No Action Total	12,000
Center for Weapons Physics Research	1,600
Replacement Office Buildings	1,800
Radiological Sciences Institute	2,800
Radioactive Liquid Waste Treatment Facility Upgrade	620
TA-55 Radiography Facility	50
Plutonium Facility Complex Refurbishment	690
Science Complex	3,300
Remote Warehouse and Truck Inspection Station	610
Waste Management Facilities Transition	500
Security-Driven Transportation Modifications	1,500
Total	26,000

TA = technical area.
[a] Construction debris includes uncontaminated wastes such as steel, brick, concrete, pipe and vegetative matter from land clearing.
Note: Values have been rounded to the nearest hundred, thousand, or million.

Even greater quantities of MDA remediation wastes would be generated under the Removal Option, with substantial quantities of demolition debris and low-level radioactive waste expected, greatly exceeding the quantities projected under the No Action Alternative. Variations in actual versus projected waste quantities would be anticipated for LANL's environmental restoration project wastes due to the difficulty in predicting selected remedies and waste types and quantities. The closure of some TA-54 Area G facilities, and subsequent remediation of the area, would generate large quantities of demolition debris and low-level radioactive waste. Industrial, hazardous, and low-level radioactive liquid wastes would also be generated by remedial actions. These liquid wastes would be treated onsite at existing LANL facilities.

Under the Expanded Operations Alternative, larger quantities of some radioactive and chemical wastes would be generated due increased levels of operations at various facilities. Expanded actinide activities at the Chemistry and Metallurgy Research Building, increased pit production (up to 50 pits per year under single-shift operations [80 pits per year using multiple shifts]) at the Plutonium Facility Complex, and increased recovery of sealed sources under the Offsite Source Recovery Program would result in larger quantities of transuranic and low-level radioactive waste. In addition, the restart of the Mixed Oxide Program, converting weapons-grade plutonium to a form usable in commercial reactors, could generate additional quantities of transuranic waste (LANL 2004i). Projections of chemical and radioactive waste quantities from routine operations at Key and Non-Key Facilities are presented in **Table 5–47**.

Radioactive liquid waste treatment volumes are expected to increase under the Expanded Operations Alternative, due to increased levels of pit production and restart of the Mixed Oxide Program. The TA-21 demolition work is expected to generate about 8,400 gallons (32,000 liters) of low-level radioactive liquid waste; this waste would be treated at the RLWTF in TA-50. Radioactive liquid waste treatment quantities are presented in **Table 5–48**.

Table 5–47 Radioactive and Chemical Waste Projections from Routine Operations – Expanded Operations Alternative

Key and Non-Key Facilities	*Waste Projections (cubic yards per year)* [a]			
	Low-Level Radioactive Waste	***Mixed Low-Level Radioactive Waste***	***Transuranic Waste***	***Chemical Waste (pounds per year)***
Chemistry and Metallurgy Research	2,600 [b]	30 [b]	90 [b]	25,000 [b]
Sigma Complex	1,300	5	0	22,000
Machine Shops	790	0	0	1,045,000
Materials Science Laboratory	0	0	0	1,300
Metropolis Center [c]	0	0	0	0
High Explosives Processing Facility	20	<1	0	29,000
High Explosives Testing Facility	1,200	1	<1	78,000
Tritium Facility	630	4	0	3,800
Pajarito Site	190	2	0	8,800
Target Fabrication Facility	13	<1	0	8,400
Bioscience Facilities	45	4	0	29,000
Radiochemistry Facility	350	5	0	7,300
Radioactive Liquid Waste Treatment Facility [d]	390	3	18	1,100
Los Alamos Neutron Science Center	1,420	1	0	37,000
Solid Radioactive and Chemical Waste Facilities [e]	300 [f]	10 [f]	35	2,000
Plutonium Facility Complex	1,400 [g]	20	690 [h]	19,000
Non-Key Facilities	1,000 [i]	40	30 [i]	1,435,000
TOTAL [j]	12,000	130	860	2,750,000

[a] Projected values from *1999 SWEIS* Record of Decision, as documented in the *2004 SWEIS Yearbook* (LANL 2005g), unless otherwise noted. Projections are based upon expected, routine facility operations and do not include wastes from non-routine events such as chemical cleanouts and construction projects.

[b] Value taken from CMRR EIS (DOE/EIS-0350).

[c] Values not projected in *1999 SWEIS* ROD. The Metropolis Center was not a designated Key Facility at that time.

[d] Values adjusted from *1999 SWEIS* projections based on historical generation rates and new projections (LANL 2006).

[e] This Key Facility includes the Transuranic Waste Retrieval Project and the Offsite Source Recovery Program.

[f] Value adjusted upward from *1999 SWEIS* projection based on projections in *Waste Volume Forecast* (LANL 2004i).

[g] Projections for transuranic and low-level radioactive waste assume pit production up to a level of 80 pits per year, based on *1999 SWEIS* projections (DOE 1999a) and more recent waste estimates (LANL 2005d).

[h] Projections for transuranic and low-level radioactive waste assume pit production up to a level of 80 pits per year, based on *1999 SWEIS* projections (DOE 1999a) and more recent waste estimates (LANL 2005d). In addition, 46 cubic yards of transuranic waste per year is projected due to restart of Mixed Oxide Program (LANL 2004i).

[i] Value adjusted upward from *1999 SWEIS* projection based on historical generation rates and projections in the *Waste Volume Forecast* (LANL 2004i).

[j] Totals may not add due to rounding.

Note: To convert cubic yards to cubic meters, multiply by 0.76456; pounds to kilograms, multiply by 0.45359. Values have been rounded to the nearest hundred, thousand, or million.

Table 5–48 Radioactive Liquid Waste Treated at Los Alamos National Laboratory – Expanded Operations Alternative

Waste Treatment Activity	*Projection* [a]
Pretreatment of radioactive liquid waste at TA-21	– [a]
Pretreatment of transuranic liquid waste from TA-55 in Room 60	50,000 gallons (190,000 liters)/year
Solidification of transuranic sludge at TA-50	22 yards^3 (17 meters^3)/year
Radioactive liquid waste treated at TA-50	5,000,000 gallons (20,000,000 liters)/year
Secondary treatment of radioactive liquid waste at TA-50	320,000 gallons (1,200,000 liters)/year
De-water low-level radioactive waste sludge at TA-50	80 yards^3 (60 meters^3)/year
Radioactive liquid waste treated at TA-53	140,000 gallons (520,000 liters)/year [b]
Transport evaporator bottoms to Tennessee	80,000 gallons (300,000 liters)/year
Receive solidified evaporator bottoms from Tennessee [c]	30 yards^3 (25 meters^3)/year

[a] No new radioactive liquid waste is being generated at TA-21, and all inventory that exists in tanks and equipment is expected to be processed by 2007.
[b] Radioactive liquid waste treated at TA-53 includes waste volumes from LANSCE plus approximately 5,000 gallons (20,000 liters) per year from TA-50.
[c] This is solid low-level radioactive waste that is disposed of at TA-54.
Source: LANL 2006.

Summary— **Table 5–49** includes a summary of waste quantities estimated for operations, DD&D, and LANL's environmental restoration projects under the Expanded Operations Alternative. Although the summary table provides waste projections only through 2016, impacts from operations are expected to continue at comparable rates for the longer term. For this summary table, the transuranic and low-level radioactive waste categories have been further subdivided (for example, contact- and remote-handled transuranic) to facilitate identification of offsite disposal options and analysis of transportation impacts. In addition, for the categories of Operational Waste and Remediation Waste, the quantities are presented as ranges rather than discrete values. For Operational Waste, the lower end of the range represents the quantity projected in the Waste Volume Forecast (LANL 2004i) and the upper end represents the *1999 SWEIS* projection, except as noted.

Waste management impacts from LANL operations under the Expanded Operations Alternative are expected to increase due to heightened operations at the Plutonium Facility Complex and increased characterization and management activities in the legacy waste retrieval program compared to the No Action Alternative. Although operational transuranic waste quantities are higher under this Alternative, waste disposal capacity at WIPP is expected to be adequate, assuming best estimates are realized. Operational low-level waste quantities are also expected to increase under this Alternative; the use of both onsite and offsite disposal options may be necessary for management of this waste. As detailed in Appendix H, improvements to the LANL waste management infrastructure would be implemented to ensure safe and efficient management of wastes.

DD&D activities are also expected to generate large quantities of waste, particularly low-level radioactive waste and uncontaminated debris. The quantities of low-level radioactive waste would exceed the Area G capacity and some portion would require offsite disposal. Uncontaminated debris would be sent offsite for disposal.

Table 5–49 Summary of Waste Types by Generator Category – Expanded Operations Alternative (Cumulative 2007 through 2016) (in cubic yards)

Waste Type	*Operational Waste* [a]	*DD&D Waste* [b]	*Remediation Waste* [c]	*Total*
Transuranic Waste				
Contact-handled	3,300 to 8,600	1,800	280 to 22,000	5,400 to 33,000
Remote-handled	–	12	0 to 50	12 to 62
Low-Level Radioactive Waste [d]				
Bulk low-level radioactive waste	–	175,000	20,000 to 710,000	194,000 to 881,000
Packaged low-level radioactive waste	25,000 to 117,000	57,000	–	81,000 to 173,000
High activity low-level radioactive waste	–	--	0 to 350,000	0 to 347,000
Remote-handled low-level radioactive waste	–	470	0 to 1,200	470 to 1,700
Mixed Low-Level Radioactive Waste	270 to 1,300	1,900	1,800 to 180,000	4,000 to 183,000
Construction and Demolition Debris [e]	26,000	584,000	47,000 to 130,000	656,000 to 736,000
Chemical Waste [g] **(pounds)**	9,997,000 to 28,000,000	4,883,000	50,000,000 to 97,000,000	65,000,000 to 129,000,000

DD&D = decontamination, decommissioning, and demolition.

[a] Operations waste volumes are represented as a range, with the lower end represented by best-estimate values documented in the Waste Volume Forecasts (LANL 2003d, 2004i), and the upper end represented by the bounding *1999 SWEIS* projections (DOE 1999a), adjusted as detailed in Table 5–47. These wastes are assumed to be contact-handled transuranic waste and packaged low-level radioactive waste, although small volumes of other types could be generated.

[b] DD&D waste quantities include those under the No Action Alternative, plus all DD&D wastes estimated to arise from new projects under the Expanded Operations Alternative as detailed in Table 5–45.

[c] Low and high ends of the ranges correspond to the MDA Capping Option and Removal Option, respectively. See Appendix I for details.

[d] The subcategories of low-level radioactive waste do not necessarily meet precise definitions, but are used to assist in the analysis of disposal and transportation options and impacts.
- Bulk low-level radioactive waste = wastes that can be transported in large volumes in soft-sided containers.
- Packaged low-level radioactive waste = typical low-level radioactive waste packaged in drums or boxes.
- High activity low-level radioactive waste = waste exceeding 10 CFR 61.55 Class A concentrations (greater than 10 nanocuries per gram of transuranic nuclides) and therefore not accepted at certain facilities.
- Remote-handled low-level radioactive waste = waste with a dose rate exceeding 200 millirem per hour at the surface of the container.

[e] Construction and demolition debris includes uncontaminated wastes such as steel, brick, concrete, pipe and vegetative matter from land clearing.

[f] Construction debris quantities include those under the No Action Alternative, plus all construction wastes estimated to arise from new projects under the Expanded Operations Alternative as detailed in Table 5–46.

[g] Chemical waste includes wastes regulated under Resource Conservation and Recovery Act, Toxic Substance Control Act, or state hazardous waste regulations.

Note: To convert cubic yards to cubic meters, multiply by 0.76456; pounds to kilograms, multiply by 0.45359. Values have been rounded to the nearest hundred, thousand, or million.

For remediation waste, the range is intended to reflect the uncertainty associated with site cleanups. Final decisions on site cleanup will be made after DOE and LANL investigate the site and propose a remedy to NMED. NMED would then accept public comment on the proposed remedy and make a final decision. For many of LANL's environmental restoration project sites, investigation is still ongoing and the remedy selection process has not begun. Thus, the remediation process, including the amount of waste generated as a result of the process, is not clearly defined. To adequately address impacts, the remediation process was analyzed under a

Capping Option, which produced relatively small amounts of waste, and a Removal Option, which involves significant intrusive cleanups and produces significantly more waste. These two options, Capping and Removal, represent the lower and upper values, respectively, in the remediation waste summary.

Under the MDA Capping Option, some remedial actions would take place at high explosives testing sites and outfalls, and retrieval of buried transuranic waste would be undertaken. Actions at most MDAs would be limited to installing an engineered cover, with wastes remaining in place. Under this option, moderate quantities of bulk low-level radioactive waste, uncontaminated debris, and chemical wastes would be expected, as well as small quantities of transuranic waste. Offsite disposal of most waste could occur, although some portion of low-level radioactive waste could be disposed at Area G, depending upon available capacity and disposal priorities.

Under the MDA Removal Option, the same remedial activities would take place as under the MDA Capping Option, with one important addition. All MDAs would be exhumed, generating very large quantities of waste, including transuranic, low-level radioactive, mixed low-level radioactive, uncontaminated debris, and chemical waste. For the categories of uncontaminated debris (managed as solid waste) and chemical wastes, offsite disposal capacity is expected to be adequate. The quantities of low-level radioactive waste would exceed the planned capacity at Area G; decisions on onsite or offsite disposal would depend upon available capacity and disposal priorities. Quantities of transuranic waste projected under the MDA Removal Option are conservative; they are based on the volume of waste as excavated (including soil) and all major MDAs being removed. There has been no credit taken for use of waste volume reduction techniques such as sorting. It is assumed that all of the transuranic waste would be disposed of at WIPP.

5.10 Transportation

This section summarizes the potential impacts associated with shipping materials to and from LANL to various locations (such as waste disposal sites and other DOE or commercial sites) under both incident-free and accident conditions. For incident-free transportation, the potential human health impacts from the radiation field surrounding the radioactive packages were estimated for transportation workers and population along the route (off-traffic, or off-link), people sharing the route (in traffic or on-link), and people at rest areas and stops along the route. The RADTRAN 5 computer program (Neuhauser and Kanipe 2003) was used to estimate the impacts for transportation workers and populations, as well as the impact to an MEI (for example, a person stuck in traffic, a gas station attendee, or an inspector), who may be a worker or a member of the public.

Human heath impacts could result from transportation accidents. The impact of a specific radiological accident is expressed in terms of probabilistic risk, which is defined as the accident probability (accident frequency) multiplied by the accident consequences. The overall risk is obtained by summing individual risks from all reasonably conceivable accidents. The analysis of accident risks takes into account a spectrum of accidents ranging from high-probability accidents of low severity (a fender bender) to hypothetical high-severity accidents that have a correspondingly low probability of occurrence. Only as a result of a severe fire or a powerful

collision, which are of extremely low probability, could a transportation package of the type used to transport radioactive material be damaged to the extent that there could be a release of radioactivity to the environment with significant consequences.

In addition to calculating the radiological risks that would result from all reasonably conceivable accidents during transportation of radioactive wastes, NNSA assessed the consequences of maximum reasonably foreseeable accidents having a probability greater than 1×10^{-7} (1 chance in 10 million) per year. The latter consequences were determined for atmospheric conditions that would prevail during accidents. The analysis used the RISKIND computer program to estimate doses to individuals and populations (Yuan et al. 1995).

Incident-free health impacts are expressed as additional LCFs. Radiological accident health impacts are also expressed as additional LCFs, and nonradiological accident risks are expressed in terms of additional immediate (traffic) fatalities. LCFs associated with radiological exposure were estimated by multiplying the occupational (worker) and public dose by 6.0×10^{-4} LCFs per person-rem of exposure. Transportation impacts of radioactive wastes were calculated assuming that all wastes are transported using truck.

In determining the transportation risks, per-shipment risk factors were calculated for the incident-free and accident conditions using the RADTRAN 5 computer program (Neuhauser and Kanipe 2003) in conjunction with the Transportation Rating Analysis Geographic Information System (TRAGIS) computer program (Johnson and Michelhaugh 2003) to choose transportation routes in accordance with U.S. Department of Transportation regulations. The TRAGIS program provides population estimates based on the 2000 census along the routes for determining the population radiological risk factors. For incident-free operations, the affected population includes individuals living within 0.5 miles (800 meters) of each side of the road. For accident conditions, the affected population includes individuals living within 50 miles (80 kilometers) of the accident, and the MEI is assumed to be an individual located 330 feet (100 meters) directly downwind from the accident.

For offsite commercial truck transportation, separate accident rates and accident fatality risks were used for rural, suburban, and urban population zones. The accident and fatality rates were taken from data provided in *State-Level Accident Rates for Surface Freight Transportation: A Reexamination*, ANL/ESD/TM-150 (Saricks and Tompkins 1999). The values selected were the "mean" accident and fatality rates given in ANL/ESD/TM-150 for "interstate," "primary," and "total." These values were assigned to rural, suburban, and urban population zones, respectively. Accident rates are generically defined as the number of accident involvements (or fatalities) in a given year per unit of travel in that same year. Therefore, the rate is a fractional value, with accident involvement count as the numerator of the fraction and vehicular activity (total travel distance in truck-kilometers) as its denominator. The accident rates were 3.15, 3.52, and 3.66 per 10 million truck-kilometers, and the fatality rates were 0.88, 1.49, and 2.32 per 100 million truck kilometers for rural, suburban, and urban zones, respectively.

For safe secure trailer (SST) transport, DOE operational experience between 1984 and 1999 was used. The mean probability of an accident requiring towing of a disabled trailer truck was about 6 per 100 million kilometers (DOE 2000g). The number of SST accidents is too small to support allocating this overall rate among the various types of routes (interstate, primary, others)

used in the accident analysis. Therefore, data for the relative rate of accidents on these route types, or influence factor, provided in *Determination of Influence Factor and Accident Rates for Armored Tractor/Safe Secure Trailer* (Phillips, Claus, and Blower 1994), was used to estimate accident frequencies for rural, urban and suburban transports. Accident fatalities for the SST transports were estimated using the commercial truck transport fatality per accident ratios within each zone.

For local and regional transport of industrial and hazardous waste, New Mexico State accident and fatality rates, also given in ANL/ESD/TM-150, were used. The rates used were: 1.13 accidents per 10 million truck-kilometers and 1.18 fatalities per 100 million truck-kilometers. For assessment purposes, the total number of expected accidents or fatalities is calculated by multiplying the total shipment distance for a specific waste by the accident or fatality rate. Additional details on the analysis approach and on modeling and parameter selection are provided in Appendix K.

In summary, at LANL, radioactive materials are transported both onsite, between the technical areas, and offsite to multiple locations. Onsite transport constitutes the majority of activities that are part of routine operations in support of various programs. The radioactive materials transported onsite between technical areas are mainly of limited quantities, short travel distances, and mostly on closed roads. The impacts of these activities are part of the normal operations at these areas. For example, worker dose from handling and transporting the radioactive materials are included as part of operational activities. Specific analyses performed in the *1999 SWEIS* (DOE 1999a) indicated that the projected collective radiation dose for LANL drivers from a projected 10,750 onsite shipments to be 10.3 person-rem per year, or on average, less than 1 millirem per transport. Review of recent onsite radioactive materials transportation indicates a much smaller number of shipments than those projected in the *1999 SWEIS*. Therefore, the *1999 SWEIS* projection of impacts would envelop the impacts for routine onsite transportation. The non-routine onsite transport activities, such as waste transport from facility DD&D or from MDA remediation, were evaluated and are presented in this SWEIS where applicable.

Offsite transports of radioactive materials would occur using both trucks and airfreight. Materials transported by air freight would be similar in number, type, and forms as those considered in the *1999 SWEIS*, and hence result in similar impacts. The air crew dose from airfreight radioactive transport was estimated at 2.4 person-rem per year (DOE 1999a).

Truck (both commercial and DOE SST) transport is analyzed further in this SWEIS. The *1999 SWEIS* provides a comprehensive listing of various radioactive material types, forms, origin and destination, quantities, and the projected number of shipments. The radioactive materials transported included, tritium, plutonium, uranium (both depleted and enriched), offsite source recovery, medical isotopes, small quantities of activation products, low-level radioactive waste, and transuranic waste. The specific origins and destinations, except for Rocky Flats, are expected to be applicable for future transports. For analyses purposes in this SWEIS, the destinations were limited to those that would be greatly affected, namely offsite waste disposal sites (such as the Nevada Test Site, a commercial waste disposal site in Utah, and WIPP in New Mexico), and sites supporting nuclear weapons production and mixed oxide fuel fabrication (such as the Pantex Plant in Texas and Savannah River Site in South Carolina). Transport of other radioactive materials would remain similar to those projected in the *1999 SWEIS*.

Table 5–50 provides the estimated number of offsite material shipments under each alternative over a 10-year period.

Table 5–50 Estimates of the Number of Offsite Shipments under Each Alternative

Alternative	Number of Shipments										
	Radioactive Materials									Miscellaneous	
	LSA Waste	DD&D Bulk	LLW (B) [a]	High Activity [b]	LLW-RH [c]	Mixed LLW	TRU [d]	SNM	PuO_2	Hazardous	Others [e]
No Action	624	784	8,517	300	0	190	1,317	600	0	950	10,764
Reduced Operations	624	784	7,283	300	0	190	1,317	600	0	938	11,764
Expanded Operations [f]	1,436 - 49,940	9,465	9,050	3,390 - 36,493	191 - 851	295 - 9,011	2,185 - 4,824	600	10	2,811 - 4,779	36,456 - 42,543

LSA = low-specific activity, DD&D = decontamination, decommissioning, and demolition, LLW = low-level radioactive waste, RH = remote handled, TRU = transuranic waste, SNM = special nuclear material, PuO_2 = plutonium dioxide.

[a] Low-level radioactive waste transported in Type A containers (drums or B-25 boxes).

[b] High activity low-level radioactive waste containing more than 10 nanocuries per gram of transuranic waste transported in B-25 Type A boxes. This waste is comparable to Class B or C of 10 CFR 61 waste classification. This waste is generated during MDA waste retrieval, and from decontaminating and demolishing of some of the buildings.

[c] Remote-handled low-level radioactive waste transported in 55-gallon (208-liter) drums.

[d] The sum of remote-handled and contact-handled transuranic waste shipments.

[e] Others include industrial, sanitary, and asbestos wastes.

[f] The range of values represents the estimated number of shipments for options of capping and remediation and removal and remediation of all MDAs.

Table 5–51 summarizes the total transportation impacts, as well as the transportation impacts on two nearby LANL transportation routes, namely LANL to Pojoaque, NM, the route segment that all trucks from LANL use; and Pojoaque to Santa Fe, NM, the route segment that all trucks using Interstate-25 (such as trucks traveling to WIPP) would use. For analyses purposes in this SWEIS, two sites, the DOE Nevada Test Site and a commercial facility in Utah were selected as possible disposal sites for low-level radioactive wastes should the decision be made to dispose low-level radioactive waste offsite rather than onsite. The differences in distance from LANL and the affected population along the different transportation routes between these two sites result in a range of impacts under each alternative. Transuranic waste would always be disposed at WIPP.

The maximum total dose to the general public would be 271 person-rem, from all shipments under the Expanded Operations Alternative – MDA Removal Option with all low-level radioactive waste being sent to the Nevada Test Site for disposal. The expected excess LCFs among the exposed population would be less than 1 (0.16 LCF). The total dose to general public under this option along the LANL to Pojoaque route would be 7.6 person-rem with less than one excess LCF (0.0046 LCF) among the exposed population. The total dose to general public along the Pojoaque to Santa Fe route would be up to 12.0 person-rem with less than one excess LCF (0.0075 LCF) among the exposed population.

Table 5–51 Risks of Transporting Radioactive Materials under Each Alternative

Alternative	Offsite Disposal Option [a]	Number of Shipments	Round Trip Kilometers Traveled (million)	Incident-Free				Accident	
				Crew		Population			
				Dose (person-rem)	LCFs	Dose (person-rem)	LCFs	Radiological Risk [b]	Nonradiological Risk [b]
No Action									
LANL to Pojoaque	NTS	12,332	0.77	4.53	0.0027	1.55	0.00093	3.6×10^{-6}	0.0087
Pojoaque to Santa Fe		12,332	0.97	7.59	0.0046	2.54	0.00153	5.8×10^{-6}	0.0110
Total		12,332	28.72	146.7	0.088	49.3	0.0296	0.000156	0.282
LANL to Pojoaque	Commercial	12,332	0.77	4.53	0.0027	1.55	0.00093	3.6×10^{-6}	0.0087
Pojoaque to Santa Fe		2,360 [c]	0.19	3.07	0.00184	1.21	0.00073	2.1×10^{-7}	0.0017
Total		12,332	25.25	129.4	0.0776	44.3	0.0266	0.000132	0.244
Reduced Operations									
LANL to Pojoaque	NTS	11,098	0.69	4.15	0.00249	1.44	0.00086	3.1×10^{-6}	0.0082
Pojoaque to Santa Fe		11,098	0.88	6.95	0.0042	2.35	0.0014	5.0×10^{-6}	0.010
Total		11,098	25.63	131.3	0.079	44.4	0.0267	0.000136	0.251
LANL to Pojoaque	Commercial	11,098	0.69	4.15	0.00249	1.44	0.00086	3.1×10^{-6}	0.0082
Pojoaque to Santa Fe		2,360 [c]	0.19	3.07	0.00184	1.21	0.00073	2.1×10^{-7}	0.0022
Total		11,098	22.60	116.2	0.070	40.2	0.024	0.000115	0.218
Expanded Operations (with MDA Removal Option)									
LANL to Pojoaque	NTS	120,244	7.48	25.07	0.0150	7.62	0.00457	0.000031	0.088
Pojoaque to Santa Fe		120,244	9.50	42.01	0.0252	12.48	0.0075	0.000046	0.112
Total		120,244	294.17	884.2	0.530	271.3	0.163	0.00156	2.93
LANL to Pojoaque	Commercial	120,244	7.48	25.07	0.0150	7.62	0.00457	0.000031	0.088
Pojoaque to Santa Fe		42,954 [c]	3.39	29.37	0.0176	9.09	0.0055	0.000023	0.040
Total		120,244	267.32	745.3	0.447	258.6	0.0155	0.00134	2.64
Expanded Operations (with MDA Capping Option)									
LANL to Pojoaque	NTS	26,622	1.66	7.18	0.0043	2.32	0.0014	5.3×10^{-6}	0.0196
Pojoaque to Santa Fe		26,622	2.1	12.02	0.0072	3.80	0.0023	8.3×10^{-6}	0.025
Total		26,622	63.5	229.80	0.138	73.6	0.044	0.00023	0.63
LANL to Pojoaque	Commercial	26,622	1.66	7.17	0.0043	2.32	0.0014	5.3×10^{-6}	0.0196
Pojoaque to Santa Fe		6,552 [c]	0.52	6.66	0.0040	2.28	0.00137	2.2×10^{-6}	0.0061
Total		26,622	56.6	208.6	0.125	67.90	0.041	0.00020	0.553

LCF = latent cancer fatality, NTS = Nevada Test Site, MDA = material disposal area.

[a] Under this option, the low-level radioactive waste would be shipped to either the Nevada Test Site or a commercial site in Utah. Transuranic wastes would be shipped to WIPP. Pantex and SRS would ship or receive special nuclear material.

[b] Risk is expressed in terms of LCF, except for the nonradiological, where it refers to the number of traffic accident fatalities.

[c] Shipment of low-level radioactive waste to a commercial disposal site in Utah would not pass along the Pojoaque to Santa Fe segment of highway.

Note: To convert kilometers to miles, multiply by 0.62137.

Onsite traffic patterns were reviewed with respect to traffic flowing through the main access points onto the site. Based on the average traffic flows recorded in 2004 and 2005, an estimate of the daily number of trips per employee was made assuming that 90 percent of all trips were related to employee trips with the remaining 10 percent related to truck trips in support of LANL activities. The alternatives were then analyzed assuming that traffic flows would fluctuate

consistent with the employment levels estimated in Section 5.8.1. For example, under the Reduced Operations Alternative, employment at LANL is projected to decline therefore the number of daily trips associated with LANL activities are also projected decline. Similarly, under the Expanded Operations Alternative, LANL employment is projected to increase and along with this increase, traffic would likely increase.

As shown in **Table 5–52**, local traffic flows would likely remain at their current levels under the No Action Alternative as employment levels would stay at their current levels. Under the Reduced Operations Alternative, a small decline in traffic through LANL would be expected mainly as a result of the projected decrease in employment under this alternative. Under the Expanded Operations Alternative, traffic would likely increase substantially due to the projected increase in employment and increased construction and remediation activities. This is particularly true for Pajarito Road as remediation activities start on MDA G. The Expanded Operations Alternative – MDA Removal Option would have a larger increase relative to the MDA – Capping Option due to the larger number of truck trips associated with MDA remediation along with a larger number of remediation workers needed to implement this option.

Table 5–52 Summary of Changes in Traffic Flow at the Entrances to Los Alamos National Laboratory

Alternative	*Average Daily Vehicle Trips*				
	Diamond Drive Across Los Alamos Canyon	***Pajarito Road at State Road 4***	***East Jemez Road at State Road 4***	***West Jemez Road at State Road 4***	***DP Road at Trinity Drive***
No Action	24,545	4,984	9,502	2,010	1,255
Reduced Operations - Estimated Daily Trips - Percent Change from No Action (%)	 23,700 -3	 4,800 -4	 9,100 -4	 1,900 -5	 1,200 -4
Expanded Operations – MDA Removal Option – Estimated Daily Trips - Percent Change from No Action (%)	 26,000 +6	 8,700 +75	 10,700 +13	 2,200 +49	 1,600 +27

MDA = material disposal area.

5.10.1 No Action Alternative

Los Alamos National Laboratory Site-Wide Impacts

Under this alternative, about 12,330 offsite shipments of radioactive materials would be made to the Nevada Test Site (or a commercial site in Utah), WIPP, and Pantex between 2007 and 2016. Maximum transportation impacts would be realized if low-level radioactive waste were shipped to either the Nevada Test Site or a commercial site in Utah instead of being disposed onsite. Transuranic waste would be shipped to WIPP, and special nuclear material would be shipped between LANL and Pantex. The total projected (one-way) distance traveled on public roads transporting radioactive materials to various locations would range from 7.8 million to 8.9 million miles (12.6 million to 14.4 million kilometers).

Impacts of Incident-free Transportation

The dose to transportation workers from all offsite transportation activities under this alternative has been estimated to range from 129 person-rem for the commercial Utah site low-level radioactive waste disposal option to 147 person-rem for Nevada Test Site disposal. The dose to the general population would range from 44 to 49 person-rem for the commercial site in Utah and the Nevada Test Site options, respectively. Accordingly, incident-free transportation would result in a maximum of 0.088 LCFs among the transportation workers and 0.030 excess LCFs in the affected population. The dose for the option that involves disposal of low-level radioactive waste at the Nevada Test Site is higher because of the longer distance traveled and larger affected population. The differences in estimated doses under either option are very small, however, as shown above.

It should be noted that the maximum annual dose to a transportation worker would be 100 millirem per year, unless the individual is a trained radiation worker. Trained radiation workers have an administrative control dose level of 2 rem per year (DOE 1999e). The potential for a trained radiation worker to develop a fatal latent cancer from an annual dose at the maximum annual exposure is 0.0012. Therefore, an individual transportation worker would not be expected to develop a lifetime latent fatal cancer from exposure during these activities.

The doses to the general population along the LANL to Pojoaque and the Pojoaque to Santa Fe routes were estimated to be a maximum of 1.6 and 2.5 person-rem, respectively. These doses would result in 0 (0.00093 and 0.0015) excess LCFs among the exposed population.

Impacts of Accidents during Transportation

As stated earlier, two sets of analyses were performed for the evaluation of transportation accident impacts: impacts of maximum reasonably foreseeable accidents (accidents with probabilities greater than 1 chance in 10 million per year [1×10^{-7}]), and impacts of all conceivable accidents (total transportation accidents).

For radioactive materials transported under this alternative, the maximum reasonably foreseeable offsite truck transportation accident with the greatest consequence would involve a truck carrying contact-handled transuranic waste. The probability of such an accident occurring would be about 1 in 5.9 million (1.7×10^{-7}) per year in an urban area. Given such an accident were to occur, the consequences in terms of general population dose would be 310 person-rem. Such an exposure could result in 0.19 excess LCFs among the exposed population. This accident, should it occur, would result in a dose of 6.2 millirem to a hypothetical MEI located at a distance of 330 feet (100 meters) and exposed to the accident plume for 2 hours, with a corresponding risk of developing a latent fatal cancer of about 1 in 270,000 (3.7×10^{-6}).

Estimates of the total offsite transportation accident risks for all projected accidents involving radioactive shipments, regardless of type, under this alternative are as follows: a maximum radiological dose-risk to the general population of 0.26 person rem, resulting in 0.00016 LCFs and a maximum nonradiological accident risk of 0 (0.28) fatalities.

The maximum radiological transportation accident dose-risk to the general population along the LANL to Pojoaque and the Pojoaque to Santa Fe routes would be 0.0060 and 0.0096 person-rem,

respectively. These doses would result in 0 (3.6×10^{-6} and 5.8×10^{-6}) excess LCFs among the exposed population. The maximum expected traffic fatalities along these routes would be 0 (0.0087) and 0 (0.011), respectively.

Impacts of Construction, Operations, and Hazardous Material Transportation

The impacts of transporting various nonradiological materials were also evaluated. These impacts are presented in terms of distance traveled and number of expected traffic accidents and fatalities. The transportation impacts under this alternative would be: 3.5 million miles (5.7 million kilometers) traveled, 1 (0.64) traffic accident, and 0 (0.07) fatalities.

Local Traffic

Under the No Action Alternative, the impact of LANL activities on local traffic flow and roadway infrastructure would be approximately the same as current conditions as described in Section 4.10.1. Efforts that are being undertaken to enhance site security, such as the Security Perimeter Project would be implemented as planned. These modifications would alter traffic patterns in and around LANL but would likely have only minor impacts on traffic flow during normal security conditions. In the case of heightened security, traffic entering the site would be delayed as vehicles were subjected to a greater level of scrutiny.

5.10.2 Reduced Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Under this alternative, about 11,100 offsite shipments of radioactive materials would be made to the Nevada Test Site (or a commercial disposal site in Utah), WIPP, and Pantex between 2007 and 2016. Similar to the No Action Alternative, the maximum transportation impacts would result from the low-level radioactive waste being shipped to either the Nevada Test Site or a commercial disposal site in Utah, the transuranic waste being shipped to WIPP, and special nuclear material being shipped between LANL and Pantex. The total projected (one-way) distance traveled on public roads transporting radioactive materials to various locations would range from 7.0 million to 7.9 million miles (11.3 million to 12.7 million kilometers).

Impacts of Incident-free Transportation

The dose to transportation workers from all offsite transportation activities under this alternative has been estimated to range from 116 person-rem for the Utah low-level radioactive waste disposal option to 131 person-rem for Nevada Test Site disposal. The dose to the general population would range from 40 to 44 person-rem for each option, respectively. Accordingly, incident-free transportation would result in a maximum of 0.079 LCFs among the transportation workers and 0.027 excess LCFs in the affected population for the option that involves disposal of low-level radioactive waste at the Nevada Test Site because of longer distance and larger affected population.

The impact of this alternative on individual transportation workers would be the same as discussed in the No Action Alternative. An individual transportation worker would not be expected to develop a lifetime latent fatal cancer from exposure during these activities.

The doses to the general population along the LANL to Pojoaque and the Pojoaque to Santa Fe routes under this alternative were estimated to be a maximum of 1.4 and 2.4 person-rem, respectively. These doses would result in 0.00086 and 0.0014 excess LCFs among the exposed population.

Impacts of Accidents during Transportation

Similar to the No Action Alternative, for radioactive materials transported under this alternative, the maximum reasonably foreseeable offsite truck transportation accident with the highest consequence would involve a truck carrying contact-handled transuranic waste. The probability of such an accident occurring would be 1 in 5.9 million (1.7×10^{-7}) per year in an urban area. The consequences of such an accident should it occur would be similar to those provided under the No Action Alternative.

Estimates of the total offsite transportation accident risks for all projected accidents involving radioactive shipments, regardless of type, under this alternative are as follows: maximum radiological dose-risk to the general population of about 0.23 person-rem, resulting in 0.00014 LCFs and a maximum nonradiological accident risk of 0 (0.25) fatalities.

The maximum radiological transportation accident dose-risk to the general population along the LANL to Pojoaque and the Pojoaque to Santa Fe routes would be 0.0052 and 0.0083 person-rem, respectively. These doses would result in 0 (3.1×10^{-6} and 5.0×10^{-6}) excess LCFs among the exposed population. The maximum expected traffic fatalities along these routes would be 0 (0.0082) and 0 (0.010), respectively.

Impacts of Construction, Operations, and Hazardous Material Transports

The impacts of transporting various nonradiological materials were also evaluated. These impacts are presented in terms of distance traveled, and number of expected traffic accidents and fatalities. The transportation impacts under this alternative would be: 3.5 million miles (5.7 million kilometers) traveled, 1 (0.64) traffic accident, and 0 (0.07) fatalities.

Local Traffic

Under the Reduced Operations Alternative, the impact of LANL activities on local traffic flow and roadway infrastructure would be somewhat lower than those expected under the No Action Alternative. The relatively small reduction in the number of employees associated with the reduction in high explosives processing and testing, cessation of TA-18 activities, and the shut down of LANSCE (see Section 5.8.1.2), would likely result in small decreases in terms of local traffic flow and the impact of site activities on local roadway infrastructure as shown in **Table 5–53**.

Table 5–53 Estimated Changes in Traffic at the Entrances to Los Alamos National Laboratory under the Reduced Operations Alternative

Activity	*Average Daily Vehicle Trips*				
	Diamond Drive Across Los Alamos Canyon	***Pajarito Road at State Road 4***	***East Jemez Road at State Road 4***	***West Jemez Road at State Road 4***	***DP Road at Trinity Drive***
No Action Alternative	24,545	4,984	9,502	2,010	1,255
Estimated Daily Vehicle Trips under Reduced Operations Alternative	23,700	4,800	9,100	1,900	1,200
Percent Change from Baseline	-3	-4	-4	-5	-4

5.10.3 Expanded Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Under this alternative, between 26,622 and 120,244 offsite shipments of radioactive materials would be made to the Nevada Test Site (or a commercial disposal site in Utah), WIPP, Pantex and the Savannah River Site between 2007 and 2016, under the MDA Capping Option and MDA Removal Option, respectively. Maximum transportation impacts would be realized in the event low-level radioactive waste was shipped to either the Nevada Test Site or a commercial site in Utah instead of being disposed onsite. Transuranic waste would be shipped to WIPP, and special nuclear material would be shipped between LANL and Pantex or Savannah River. The total projected (one-way) distance traveled on public roads transporting radioactive materials to various locations would range from 17.6 million to 19.8 million miles (28.3 million to 31.8 million kilometers) under the MDA Capping Option to 83.1 million to 91.4 million miles (133.7 million to 147.1 million kilometers) under the MDA Removal Option.

Impacts of Incident-free Transportation

The dose to transportation workers from all offsite transportation activities under this alternative would range from 209 to 745 person-rem for the Utah low-level radioactive waste disposal option to 230 to 884 person-rem for Nevada Test Site disposal for the MDA Capping Option and MDA Removal Option. The dose to the general population would range from 68 to 74 person-rem for the MDA Capping Option to 259 to 271 person-rem for the MDA Removal Option. Accordingly, incident-free transportation would result in a maximum of 0.14 LCFs among transportation workers and 0.044 excess LCFs in the affected population for the MDA Capping Option, and a maximum of 0.53 LCFs among transportation workers and 0.16 excess LCFs in the affected population for the MDA Removal Option. The doses for options involving disposal of low-level radioactive waste at the Nevada Test Site are higher because of longer distances involved and larger affected population.

The impact of this alternative on individual transportation workers would be the same as discussed in the No Action Alternative. An individual transportation worker would not be expected to develop a lifetime latent fatal cancer from exposure during these activities.

The doses to the general population along the LANL to Pojoaque and the Pojoaque to Santa Fe routes were estimated to be a maximum of 2.3 and 3.8 person-rem, respectively, under the MDA Capping Option. These doses would result in 0 (0.0014 and 0.0023) excess LCFs among the exposed population. Under the MDA Removal Option, the doses to the general population along the LANL to Pojoaque and the Pojoaque to Santa Fe routes were estimated to be a maximum of 7.6 and 12.5 person-rem, respectively. These doses would result in 0 (0.0046 and 0.0075) excess LCFs among the exposed population.

Impacts of Accidents during Transportation

Similar to the No Action Alternative, for radioactive materials transported under this alternative, the maximum reasonably foreseeable offsite truck transportation accident with the highest consequence would involve a truck carrying contact-handled transuranic waste. The probability of such an accident occurring would be about 1 in 4 million (2.5×10^{-7}) per year in an urban area under the MDA Capping Option and 1 in 2 million (4.9×10^{-7}) per year in an urban area for the MDA Removal Option. The consequences of such an accident should it occur would be similar to those provided under the No Action Alternative.

Estimates of the total offsite transportation accident risks for all projected accidents involving radioactive shipments, regardless of type, under this alternative are as follows: maximum radiological dose risk to the general population of 0.38 person-rem, resulting in 0.00023 LCFs and a maximum nonradiological accident risk of 1 (0.63) fatality under the MDA Capping Option, and 2.6 person-rem, resulting in 0.0016 LCFs and a maximum nonradiological accident risk of 3 (2.9) fatalities under the MDA Removal Option.

The maximum radiological transportation accident dose-risk to the general population along the LANL to Pojoaque and the Pojoaque to Santa Fe routes would be about 0.0088 and 0.0139 person-rem under the MDA Capping Option, and about 0.052 and 0.076 person-rem under the MDA Removal Option. These doses would result in 0 (5.3×10^{-6} and 8.3×10^{-6} for the MDA Capping Option, and 3.1×10^{-5} and 4.6×10^{-5} for the MDA Removal Option) excess LCFs among the exposed population under either MDA remediation option. The maximum expected traffic fatalities along these routes would be 0 (0.0196) and 0 (0.025), respectively, under the MDA Capping Option. Under the MDA Removal Option, the maximum expected traffic fatalities along these routes would be 0 (0.088) and 0 (0.11), respectively.

Impacts of Construction, Operations, and Hazardous Material Transports

The impacts of transporting various nonradiological materials were also evaluated. These impacts are presented in terms of distance traveled, and number of expected traffic accidents and fatalities. The transportation impacts under this alternative for the MDA Capping Option would be: 15.3 million miles (24.6 million kilometers) traveled, 3 (2.8) traffic accidents, and 0 (0.29) fatalities. For the MDA Removal Option, the nonradiological transportation impacts would be: 17.5 million miles (28.2 million kilometers) traveled, 3 (3.2) traffic accidents, and 0 (0.33) fatalities.

Local Traffic

Under the Expanded Operations Alternative, the impact of LANL activities on local traffic flow and roadway infrastructure could be substantial without changes to current conditions. The potential addition of thousands of new employees combined with an increased number of trucks traveling to and from the site associated with increased construction, DD&D, and MDA remediation activities could have a damaging effect on local transportation. As shown in **Table 5–54**, there are a number of intersections that could see large increases in daily traffic flow.

Table 5–54 Estimated Changes in Traffic at the Entrances to Los Alamos National Laboratory under the Expanded Operations Alternative

Activity	*Average Daily Vehicle Trips*				
	Diamond Drive Across Los Alamos Canyon	***Pajarito Road at State Road 4***	***East Jemez Road at State Road 4***	***West Jemez Road at State Road 4***	***DP Road at Trinity Drive***
No Action Alternative	24,545	4,984	9,502	2,010	1,255
Estimated Daily Vehicle Trips under Expanded Operations Alternative	26,000	8,700	10,700	2,200	1,600
Percent Change from Baseline	+6	+75	+13	+9	+27

Areas of concern include the increased truck traffic East Jemez Road at State Road 4, if it continues to be the lone route for all trucks traveling to LANL or the Los Alamos town site. With a number of construction projects and MDA remediation efforts occurring along Pajarito Road related to efforts that are expected to be underway in TA-18, TA-54, TA-55 and TA-3 under this Alternative, it may become necessary to consider an alternative truck entry point for trucks working on these projects on Pajarito Road at State Road 4 to alleviate some of the truck traffic on East Jemez.

Under the proposal to construct a new warehouse on East Jemez Road, a traffic study concluded that the level of service on East Jemez would lead to breakdown in traffic flow during the afternoon rush hour without changes to the current road (LSC 2005). The study concluded that left turn lanes would be needed and acceleration lanes for east and west bound traffic on East Jemez Road (see Appendix G.9). These concerns would likely be further exacerbated by the increased remediation activities under the Expanded Operations Alternative. For example, there would be a substantial increase in truck traffic into and out of the TA-61 borrow pit under the MDA Capping Option. Under this option, an average of about 60 truckloads of fill could be needed daily out of this borrow pit over a 10 year period. Trucks coming in and out of the pit would likely delay traffic flow on East Jemez Road and add to the noise levels around this area.

The intersection of Trinity Drive and DP Road is already an area of concern. As discussed in Section 4.10.2, the New Mexico Department of Transportation is planning improvements to this intersection that will improve the ability of trucks to leave DP Road and turn onto Trinity Drive. Expected increases in traffic during the period that TA-21 is undergoing DD&D and MDAs A, B, T, and U are being remediated increase the need for these improvements. The concerns with additional trucks entering and leaving DP Road and the affect of increased truck traffic on the

local road infrastructure may result in the need for another entry point to the technical area during periods of heavy activity.

There are also expected to be large increases over the No Action Alternative on Pajarito Road, however, the level of usage on this road is much lower than on the other main access points into and out of LANL. Further traffic studies may need to be conducted to determine if any changes are needed in the event all of the planned projects progressed on their current schedules under the Expanded Operations Alternative. Pajarito Road would experience the largest increases in traffic once remediation efforts start at MDA G. It may become necessary to regulate the traffic flow at its intersection with State Road 4 during peak travel hours under this scenario.

5.11 Environmental Justice

The environmental justice analysis assesses the potential for disproportionately high and adverse human health or environmental effects on minority and low-income populations that could result from implementation of the alternatives considered in this SWEIS. In assessing the impacts, the following definitions of minority individuals and populations and low-income population were used:

- *Minority individuals:* Individuals who identify themselves as members of the following population groups: Hispanic or Latino, American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, or two or more races meaning individuals who identified themselves on the census form as being a member of two or more races, for example, Hispanic and Asian.

- *Minority populations*: Minority populations are identified where either: (1) the minority population of the affected area exceeds 50 percent, or (2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.

- *Low-income population*: Low-income populations in an affected area are identified with the annual statistical poverty thresholds from the Census Bureau's Current Population Reports, Series PB60, on Income and Poverty.

Consistent with the impact analysis for the public and occupational health and safety, the affected populations are defined as those minority and low-income populations that reside within a 50-mile (80-kilometer) radius centered on the LANSCE Facilities at TA-53 at LANL. Based on the analysis of impacts for other resource areas, DOE expects few high and adverse impacts from the continued operation of LANL under any of the alternatives, and, to the extent impacts may be high and adverse, DOE expects the impacts to affect all populations in the area equally. DOE also analyzed the potential risk due to radiological exposure through the consumption patterns of special pathway receptors, including subsistence consumption of fish, native vegetation, surface waters, sediments, and local produce; absorption of contaminants in sediments through the skin; and inhalation of plant materials. The special pathway receptors analysis is important to the environmental justice analysis because this consumption pattern may reflect the traditional or cultural practices of minority populations in the area.

Subsistence Consumption of Fish and Wildlife

Section 4–4 of Executive Order 12898 directs Federal agencies "whenever practical and appropriate, to collect and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence and that Federal governments communicate to the public the risks of these consumption patterns." In the *1999 SWEIS*, DOE considered whether there were any means for minority or low-income populations to be disproportionately affected by examining impacts to American Indian, Hispanic, and other traditional lifestyle special pathway receptors. Special pathways were considered that took into account the levels of contaminants in native vegetation (piñon nuts and indian tea [Cota]), crops, soils and sediments, surface water, fish, and game animals on or near LANL.

Based on recent DOE monitoring results, concentrations of contaminants in native vegetation (piñon nuts), crops, soils and sediments, surface water, fish, and game animals in areas surrounding LANL have been quite low (at or near the threshold of detection), and were seldom above background levels (see Appendix C.1.4). Additional exposures to a person whose diet and activities reflect those of subsistence consumption of fish and wildlife would bring their total dose to just less than 4 millirem (0.004 rem) per year. Using a risk estimator value of 0.0006 lifetime probability of fatal cancer per person-rem, 0.004 rem per year would equate to an annual risk of developing a fatal cancer from this dose of about 1 in 415,000 (2.4×10^{-6}), from the ingestion pathway. Ingestion pathway calculations included concentrations of radionuclides in environmental media reported in LANL environmental surveillance reports for 2001 through 2004. This includes natural background, weapons testing fallout, and previous radiological releases from LANL. The actual contribution from recent operations at LANL is only a small fraction of this value. The overall risk to the special pathway receptor would not differ between the alternatives considered in this new SWEIS, because most of the risk is attributed to the existing low levels of radiological contamination in water and soils in the area around LANL. Consequently, no disproportionately high and adverse human health impacts would be expected in special pathway receptor populations in the region as a result of subsistence consumption of fish and wildlife.

5.11.1 No Action Alternative

Los Alamos National Laboratory Site-Wide Impacts

There would be no disproportionately high and adverse environmental impacts on minority and low-income populations due to construction activities at LANL under the No Action Alternative. This conclusion is a result of investigations in this SWEIS that determined there were no significant impacts on human health, ecological, cultural, paleontological, socioeconomic, and other resource areas described in other subsections of this chapter.

Under the No Action Alternative, all current nuclear production operations would be conducted in existing or replacement facilities at LANL and no new nuclear operations would be conducted. As discussed in Sections 5.6.1 and 5.6.2, radiological and hazardous chemical risks to the public resulting from normal operations would be small. In summary, implementation of the No Action Alternative would pose no disproportionately high and adverse health and safety risks to low-income or minority populations living in the potentially affected area surrounding LANL.

Key Facilities Impacts

Routine normal operations at Key Facilities would not be expected to cause fatalities or illness among the general population, including minority and low-income populations living within the potentially affected area.

The annual radiological risks to the offsite population that could result from the maximum potential accidents at Key Facilities are estimated to be less than 0.22 LCFs (see Section 5.12.1). Thus, no excess LCFs would be expected in the entire offsite population resulting from an accident under the No Action Alternative.

5.11.2 Reduced Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Implementation of the Reduced Operations Alternative would pose no disproportionately high and adverse health and safety risks to low-income or minority populations living in the potentially affected area surrounding LANL. Under the Reduced Operations Alternative, the risk of disproportionately high and adverse environmental impacts on minority and low-income populations in the vicinity of LANL would be no higher than those described under the No Action Alternative, and, in some cases, would be lower than the risk associated with the No Action Alternative.

5.11.3 Expanded Operations Alternative

Los Alamos National Laboratory Site-Wide Impacts

Based on the analysis of impacts for other resource areas in this chapter, there would be few high and adverse impacts from the continued operation of LANL under the Expanded Operations Alternative, and, to the extent impacts may be high and adverse, the impacts would affect all populations within the study area equally.

Construction Impacts—There would be no disproportionately high and adverse environmental impacts on minority and low-income populations due to construction activities at LANL that would occur under this alternative, or from the impacts of project-specific activities discussed in Appendices G, H, I, and J. As stated in other subsections of this chapter, environmental impacts from construction under this alternative would be small and would not be expected to significant and adverse beyond the LANL site boundary.

Operational Impacts—No disproportionately high and adverse environmental impacts on minority and low-income populations would occur under this alternative. This conclusion is a result of analyses presented in this SWEIS that determined there were no significant impacts on human health, ecological, cultural, paleontological, socioeconomic, and other resource areas described in other subsections of this chapter.

As discussed in Section 5.6.1 and 5.6.2, radiological and hazardous chemical risks to the public resulting from normal operations would be small.

Key Facilities Impacts

Routine normal operations at Key Facilities would not be expected to cause fatalities or illness among the general population, including minority and low-income populations living within the potentially affected area.

The annual radiological risks to the offsite population that could result from the maximum potential accidents at Key Facilities are estimated to be less than 0.22 LCFs (see Section 5.12.1). Thus, no excess LCFs would be expected in the entire offsite population resulting from an accident under the Expanded Operations Alternative.

5.12 Facility Accidents

The estimated impacts of potential accidents are described in this section for the No Action, Reduced Operations, and Expanded Operations Alternatives. A summary of the risks from radiological and chemical operations, potential seismic events, and a potential wildfire is provided in **Table 5–55**. Radiological impacts from facility accidents are addressed in Section 5.12.1. Chemical impacts from facility accidents are addressed in Section 5.12.2. Impacts from postulated earthquake events that could simultaneously affect multiple facilities are addressed in Section 5.12.3. Another natural event that can also impact multiple facilities, a wildfire, is addressed in Section 5.12.4. Additional details on the accident analysis are provided in Appendix D.

5.12.1 Facility Radiological Impacts

Radiological accident estimated consequences and risks associated with the No Action, Reduced, and Expanded Alternatives are shown in Tables 5–56 through 5–61.

5.12.1.1 No Action Alternative

The accident with the highest estimated consequences to the offsite population and MEI, as shown in **Tables 5–56** and **5–57**, is a building fire and spill at DVRS. If this accident were to occur, there could be 3.68 additional LCFs in the offsite population. The accident with the highest estimated consequences to the MEI is a fire at a waste storage dome. If this accident were to occur, an LCF to a noninvolved worker located 109 yards (100 meters) from the site of the accident would be likely, and there would also be a 0.50 likelihood (1 chance in 2) of an LCF to the MEI, assumed to be present at the nearest site boundary for the duration of the accident release. The MEI for all of the scenarios is located at the nearest site boundary.

The potential for exposures in excess of these at CMR exists because of public access to Diamond Drive, approximately 50 meters from the facility. The consequences to an individual at this Diamond Drive location during the HEPA Filter Fire would be 8.10 rem, resulting in an increased risk of a fatal latent cancer during the lifetime of the individual of 0.00486 or approximately 1 chance in 205. Appendix D (see Section D.3.2.1) contains further discussion of the CMR exposures.

Table 5–55 Summary of Worker and Public Radiological Risks and Chemical Consequences from Potential Accidents

Maximum Potential Accident	*No Action Alternative*	*Reduced Operations Alternative*	*Expanded Operations Alternative*
Facility Radiological Release			
• Offsite Population (LCF per year)	0.02	0.02	0.02
• MEI (LCF per year)	0.0009	0.0009	0.0009
• Noninvolved Worker (LCF per year)	0.006	0.006	0.006
Facility Chemical Release [a]			
• Concentrations above which life-threatening health effects could result (ERPG-3 [t] limit)	5 parts per million	5 parts per million	5 parts per million
• ERPG-3 distance	881 meters	881 meters	881 meters
• Distance to the site boundary	491 meters	491 meters	491 meters
Site-Wide Seismic Event Radiological			
• Offsite Population (LCF per year)	0.005	0.005	0.005
• MEI (LCF per year)	0.0003	0.0003	0.0003
• Noninvolved Worker (LCF per year)	0.001	0.001	0.001
Site-Wide Seismic Event Chemical [a]			
• Concentrations above which life-threatening health effects could result (ERPG-3 [t] limit)	25 parts per million	25 parts per million	25 parts per million
• ERPG-3 distance	110 meters	110 meters	110 meters
• Distance to the site boundary	12 meters	12 meters	12 meters
Wildfire Radiological			
• Offsite Population (LCF per year)	2.7	2.7	2.7
• MEI (LCF per year)	0.05	0.05	0.05
• Noninvolved Worker (LCF per year)	0.05	0.05	0.05
Wildfire Chemical [a]			
• Concentrations above which life-threatening health effects could result (ERPG-3 [t] limit)	25 parts per million	25 parts per million	25 parts per million
• ERPG-3 distance	89 meters	89 meters	89 meters
• Distance to the site boundary	12 meters	12 meters	12 meters

LCF = latent cancer fatality, MEI = maximally exposed individual, ERPG = Emergency Response Planning Guideline.
[a] ERPG-3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects (DOE 2005c).

After taking into account the frequency of the postulated accidents (see Appendix D), the estimated highest risk accident would be a Radioactive Assay and Nondestructive Test (RANT) Outdoor Container Storage Area Fire (TA-54-38). **Table 5–58** shows the annual risk of an increased likelihood of an LCF for this accident to be 0.000858 (about one chance in 1,150 years) for the MEI. The offsite population annual risk of additional LCFs is estimated to be 0.0238 (about one chance in 40 years for an LCF in the total population) for any one member of the offsite population. Table 5–58 shows the annual risk of an increased likelihood of an LCF for this accident to be 0.00638 (about one chance in 157 years) for a noninvolved worker.

Table 5–56 Radiological Accident Offsite Population Consequences for the No Action Alternative

Accident Scenario	Maximally Exposed Individual		Population to 50 Miles (80 kilometers)	
	Dose (rem)	Latent Cancer Fatality Risk [a]	Dose (person-rem)	Latent Cancer Fatalities [b, c]
RANT Outdoor Container Storage Area Fire (TA-54-38)	71.5	0.0858	3,970	2.38
Fire at WETF (TA-16-205)	5.91	0.00355	187	0.112
WCRR Outdoor Storage Area Fire (TA-50-69)	1.10	0.000660	265	0.159
Waste Storage Dome Fire (TA-54)	419	0.503	4,230	2.54
Onsite Transuranic Waste Transportation Accident and Fire (TA-54)	186	0.223	5,720	3.43
Plutonium Facility Storage Container Release (TA-55-4)	2.50	0.00150	372	0.223
Plutonium Facility Ion Column Rupture (TA-55-4)	1.28	0.000768	131	0.0786
DVRS Operational Spill (TA-54-412)	19.6	0.0118	185	0.111
DVRS Building Fire and Spill Due to Forklift Collision (TA-54-412)	321	0.385	6,140	3.68
SHEBA Hydrogen Detonation (TA-18-168)	0.877	0.000526	69	0.0414
CMR HEPA Filter Fire (TA-3-29)	0.774	0.000464	200	0.12

RANT = Radioactive Assay and Nondestructive Test, TA = technical area, WETF = Weapons Engineering Tritium Facility, WCRR = Waste Characterization, Reduction, and Repackaging Facility, DVRS = Decontamination and Volume Reduction System, SHEBA = Solution High-Energy Burst Assembly CMR = Chemistry and Metallurgy Research Building, HEPA = high-efficiency particulate air (filter).

[a] Increased risk of an LCF to an individual, assuming the accident occurs.

[b] Increased number of LCFs for the offsite population, assuming the accident occurs.

[c] Offsite population size out to a 50-mile (80-kilometer) radius is approximately 297,000 (TA-3-29), 404,900 (TA-16-205), 334,100 (TA-18-168), 271,600 (TA-21-155, -209), 302,000 (TA-50-69), 343,100 (TA-54-38, DVRS, TA-54-412, Domes), 301,900 (TA-55-4).

Table 5–57 Radiological Accident Onsite Worker Consequences for the No Action Alternative

Accident Scenario	Noninvolved Worker at 110 Yards (100 meters)	
	Dose (rem)	Latent Cancer Fatality Risk [a]
RANT Outdoor Container Storage Area Fire (TA-54-38)	532	0.638
Fire at WETF (TA-16-205)	8.92	0.00535
WCRR Outdoor Storage Area Fire (TA-50-69)	44.7	0.0536
Waste Storage Dome Fire (TA-54)	1,950	1.00 [b]
Onsite Transuranic Waste Transportation Accident and Fire (TA-54)	761	0.913
Plutonium Facility Storage Container Release (TA-55-4)	35.8	0.0430
Plutonium Facility Ion Column Rupture (TA-55-4)	9.09	0.00545
DVRS Operational Spill (TA-54-412)	51.4	0.0617
DVRS Building Fire and Spill Due to Forklift Collision (TA-54-412)	888	1.00 [b]
SHEBA Hydrogen Detonation (TA-18-168)	15.4	0.00924
CMR HEPA Filter Fire (TA-3-29)	5.38	0.00323

RANT = Radioactive Assay and Nondestructive Test, TA = technical area, WETF = Weapons Engineering Tritium Facility, WCRR = Waste Characterization, Reduction, and Repackaging Facility, DVRS = Decontamination and Volume Reduction System, SHEBA = Solution High-Energy Burst Assembly, CMR = Chemistry and Metallurgy Research Building, HEPA = high-efficiency particulate air filter.

[a] Increased risk of an LCF to an individual, assuming the accident occurs.

[b] The indicated dose yields a risk value greater than 1.00. This means that it is likely that an individual exposed to the indicated dose would contract a fatal latent cancer in their lifetime. For this reason a value of 1.00 is shown.

Table 5–58 Radiological Accident Offsite Population and Worker Risks for the No Action Alternative

Accident Scenario	Frequency (per year)	Onsite Worker	Offsite Population	
		Risk to Noninvolved Worker at 110 Yards (100 meters) [a]	Risk to Maximally Exposed Individual [a]	Latent Cancer Fatalities [b, c]
RANT Outdoor Container Storage Area Fire (TA-54-38)	0.01	0.00638	0.000858	0.0238
Fire at WETF (TA-16-205)	1.1×10^{-5}	5.89×10^{-8}	3.95×10^{-8}	1.25×10^{-6}
WCRR Outdoor Storage Area Fire (TA-50-69)	0.0003	0.0000161	1.98×10^{-7}	0.0000477
Waste Storage Dome Fire (TA-54)	0.001	0.001	0.000503	0.00254
Onsite Transuranic Waste Transportation Accident and Fire (TA-54)	0.001	0.000913	0.000223	0.00343
Plutonium Facility Storage Container Release (TA-55-4)	1.0×10^{-6}	4.3×10^{-8}	1.50×10^{-9}	2.23×10^{-7}
Plutonium Facility Ion Column Rupture (TA-55-4)	1.0×10^{-6}	5.45×10^{-9}	7.68×10^{-10}	7.86×10^{-8}
DVRS Operational Spill (TA-54-412)	0.02	0.00123	0.000235	0.00222
DVRS Building Fire and Spill Due to Forklift Collision (TA-54-412)	0.001	0.001	0.000385	0.00368
SHEBA Hydrogen Detonation (TA-18-168)	0.0054	0.0000499	2.84×10^{-6}	0.000224
CMR HEPA Filter Fire (TA-3-29)	0.01	0.0000323	4.64×10^{-6}	0.00120

RANT = Radioactive Assay and Nondestructive Test, TA = technical area, WETF = Weapons Engineering Tritium Facility, WCRR = Waste Characterization, Reduction, and Repackaging Facility, DVRS = Decontamination and Volume Reduction System, SHEBA = Solution High-Energy Burst Assembly, CMR = Chemistry and Metallurgy Research Building, HEPA = high-efficiency particulate air filter.

[a] Increased risk of an LCF to an individual per year.

[b] Increased number of LCFs for the offsite population per year.

[c] Offsite population size out to a 50-mile (80-kilometer) radius is approximately 297,000 (TA-3-29), 404,900 (TA-16-205), 334,100 (TA-18-168), 271,600 (TA-21-155, -209), 302,000 (TA-50-69), 343,100 (TA-54-38, DVRS, Domes), 301,900 (TA-55-4).

5.12.1.2 Reduced Operations Alternative

The accident impacts from the Reduced Operations Alternative are largely the same as those from the No Action Alternative. Activities at TA-18 including operation of SHEBA would cease under this alternative. Inspection of the tables shows that SHEBA operations are a small component of the facility impacts at LANL; its elimination would not significantly alter the overall risk profile of individual facility operations. All other impacts in the tables are equally applicable for this alternative.

5.12.1.3 Expanded Operations Alternative

The accident impacts from the Expanded Operations Alternative, shown in **Tables 5–59** through **5–61**, are generally greater than those from the No Action Alternative. SHEBA operations would cease for the Expanded Operations Alternative; its impacts, although relatively small, have been eliminated from the tables. Additional or replacement risks from accident impacts would result from expanded waste management activities. Transuranic waste storage would be consolidated in a new facility, the Transuranic Waste Consolidation Facility, located in TA-50 or TA-63. The

impacts from this new facility would be less than those of the existing facilities because of the new location and because less material would be stored, the rest being moved offsite. The entries in Tables 5–59 through 5–61 reflect the present DVRS and waste storage domes operations because they would bound the impacts of the new facility. Accident impacts for the new facility are described in Appendix H.

Table 5–59 Radiological Accident Offsite Population Consequences for the Expanded Operations Alternative

Accident Scenario	*Maximally Exposed Individual*		*Population to 50 Miles (80 kilometers)*	
	Dose (rem)	*Latent Cancer Fatality Risk* [a]	*Dose (person-rem)*	*Latent Cancer Fatalities* [b, c]
RANT Outdoor Container Storage Area Fire (TA-54-38)	71.5	0.0858	3,970	2.38
Fire at WETF (TA-16-205)	5.91	0.00355	187	0.112
WCRR Outdoor Storage Area Fire (TA-50-69)	1.10	0.000660	265	0.159
Waste Storage Dome Fire (TA-54)	419	0.503	4,230	2.54
Onsite Transuranic Waste Transportation Accident and Fire (TA-54)	186	0.223	5,720	3.43
Plutonium Facility Storage Container Release (TA-55-4)	2.50	0.00150	372	0.223
Plutonium Facility Ion Column Rupture (TA-55-4)	1.28	0.000768	131	0.0786
DVRS Operational Spill (TA-54-412)	19.6	0.0118	185	0.111
Explosion at MDA G	55.2	0.0662	766	0.460
DVRS Building Fire and Spill Due to Forklift Collision (TA-54-412)	321	0.385	6,140	3.68
Fire at CMR Involving Sealed Sources (TA-3-29)	0.0987	0.0000592	11,600	6.96
CMR HEPA Filter Fire (TA-3-29)	0.774	0.000464	200	0.12

RANT = Radioactive Assay and Nondestructive Test, TA = technical area, WETF = Weapons Engineering Tritium Facility, WCRR = Waste Characterization, Reduction, and Repackaging Facility, DVRS = Decontamination and Volume Reduction System, MDA = material disposal area, CMR = Chemistry and Metallurgy Research Building, HEPA = high-efficiency particulate air filter.

[a] Increased risk of an LCF to an individual, assuming the accident occurs.

[b] Increased number of LCFs for the offsite population, assuming the accident occurs.

[c] Offsite population size out to a 50-mile (80-kilometer) radius is approximately 297,000 (TA-3-29), 404,900 (TA-16-205), 271,600 (TA-21-155, -209), 302,000 (TA-50-69), 343,100 (TA-54-38, DVRS, Domes), 301,900 (TA-55-4).

MDA cleanup is a component of the Expanded Operations Alternative. A number of scenarios were considered for this activity and an explosion during cleanup operations that breaches the MDA enclosure and bypasses the HEPA filtration was chosen. MDA G, because of its relatively large inventory, bounds the accident impacts from MDA cleanup. The consequences and risks from this scenario are included in Tables 5–59 through 5–61. As with the No Action Alternative, TA-54 operations generally dominate the accident risks from Expanded Operations. Cleanup of MDA G in TA-54 adds a component to this risk. Appendix I includes more details about MDA cleanup accident impacts.

Table 5–60 Radiological Accident Onsite Worker Consequences for the Expanded Operations Alternative

Accident Scenario	*Noninvolved Worker at 109 Yards (100 meters)*	
	Dose (rem)	*Latent Cancer Fatality Risk* [a]
RANT Outdoor Container Storage Area Fire (TA-54-38)	532	0.638
Fire at WETF (TA-16-205)	8.92	0.00535
WCRR Outdoor Storage Area Fire (TA-50-69)	44.7	0.0536
Waste Storage Dome Fire (TA-54)	1,950	1.00 [b]
Onsite Transuranic Waste Transportation Accident and Fire (TA-54)	761	0.913
Plutonium Facility Storage Container Release (TA-55-4)	35.8	0.0430
Plutonium Facility Ion Column Rupture (TA-55-4)	9.09	0.00545
DVRS Operational Spill (TA-54-412)	51.4	0.0617
Explosion at MDA G	405	0.486
DVRS Building Fire and Spill Due to Forklift Collision (TA-54-412)	888	1.00 [b]
Fire at CMR Involving Sealed Sources (TA-3-29)	1.21	0.000727
CMR HEPA Filter Fire (TA-3-29)	5.38	0.00323

RANT = Radioactive Assay and Nondestructive Test, TA = technical area, WETF = Weapons Engineering Tritium Facility, WCRR = Waste Characterization, Reduction, and Repackaging Facility, DVRS = Decontamination and Volume Reduction System, MDA = material disposal area, CMR = Chemistry and Metallurgy Research Building, HEPA = high-efficiency particulate air filter.

[a] Increased risk of an LCF to an individual, assuming the accident occurs.

[b] The indicated dose yields a risk value greater than 1.00. This means that it is likely that an individual exposed to the indicated dose would contract a fatal latent cancer in their lifetime. For this reason a value of 1.00 is shown.

The accident with the highest consequences to the offsite population is a fire at CMR involving sealed sources as shown in Table 5–59. If this accident were to occur, there could be 6.96 additional LCFs in the offsite population. The accident with the highest consequences to the MEI is a building fire and spill at DVRS. If this accident were to occur, there would be a 0.385 likelihood (1 chance in 2.6) of an LCF to the MEI. The MEI for all of the scenarios is located at the nearest site boundary. The accident with the highest consequences to the noninvolved worker is a waste storage dome fire. If this accident were to occur, an LCF to a noninvolved worker located 110 yards (100 meters) from the site of the accident would be likely. If a building fire and spill at DVRS were to occur, an LCF to the noninvolved worker would also be likely.

The potential for exposures in excess of these at CMR exists because of public access to Diamond Drive, approximately 50 meters from the facility. The consequences to an individual at this Diamond Drive location during the Fire Impacting Sealed Sources (a component of only the Expanded Operations Alternative) or the HEPA Filter Fire would be 4.32 rem and 8.10 rem, respectively. These doses would result in an increased risk of a fatal latent cancer during the lifetime of the individual of 0.00259 (approximately 1 chance in 385) and 0.00486 (approximately 1 chance in 205), respectively. Appendix D (see Section D.3.2.1) contains further discussion of the CMR exposures.

After taking into account the frequency of the postulated accidents, the estimated highest risk accident would be a RANT Outdoor Container Storage Area Fire (TA-54-38). Table 5–61 shows the annual risk of an increased likelihood of an LCF for this accident to be 0.000858 (about one chance in 1,100 years for the MEI) for the MEI. The offsite population annual risk of additional

LCFs is shown to be 0.0238 (about one chance in 40 years for an LCF in the total population) for any one member of the offsite population. Table 5–61 shows the annual risk of an increased likelihood of an LCF for this accident to be 0.00638 (about one chance in 157 years) for a noninvolved worker.

Table 5–61 Radiological Accident Offsite Population and Worker Risks for the Expanded Operations Alternative

Accident Scenario	*Frequency (per year)*	*Risk to Onsite Worker*	*Offsite Population*	
		Risk to Noninvolved Worker at 109 Yards (100 meters) [a]	*Risk to Maximally Exposed Individual* [a]	*Population to 50 Miles (80 kilometers)* [b, c]
RANT Outdoor Container Storage Area Fire (TA-54-38)	0.01	0.00638	0.000858	0.0238
Fire at WETF (TA-16-205)	1.1×10^{-5}	5.89×10^{-8}	3.95×10^{-8}	1.25×10^{-6}
WCRR Outdoor Storage Area Fire (TA-50-69)	0.0003	0.0000161	1.98×10^{-7}	0.0000477
Waste Storage Dome Fire (TA-54)	0.001	0.001	0.000503	0.00254
Onsite Transuranic Waste Transportation Accident and Fire (TA-54)	0.001	0.000913	0.000223	0.00343
Plutonium Facility Storage Container Release (TA-55-4)	1.0×10^{-6}	4.30×10^{-8}	1.50×10^{-9}	2.23×10^{-7}
Plutonium Facility Ion Column Rupture (TA-55-4)	1.0×10^{-6}	5.45×10^{-9}	7.68×10^{-10}	7.86×10^{-8}
DVRS Operational Spill (TA-54-412)	0.02	0.00123	0.000235	0.00222
Explosion at MDA G	0.01	0.00486	0.000662	0.00460
DVRS Building Fire and Spill Due to Forklift Collision (TA-54-412)	0.001	0.001	0.000385	0.00368
Fire at CMR Involving Sealed Sources (TA-3-29)	0.00024	1.74×10^{-7}	1.42×10^{-8}	0.00167
CMR HEPA Filter Fire (TA-3-29)	0.01	0.0000323	4.64×10^{-6}	0.00120

RANT = Radioactive Assay and Nondestructive Test, TA = technical area, WETF = Weapons Engineering Tritium Facility, WCRR = Waste Characterization, Reduction, and Repackaging Facility, DVRS = Decontamination and Volume Reduction System, MDA = material disposal area, CMR = Chemistry and Metallurgy Research Building, HEPA = high-efficiency particulate air filter.

[a] Increased risk of an LCF to an individual per year.

[b] Increased number of LCFs for the offsite population per year.

[c] Offsite population size out to a 50-mile (80-kilometer) radius is approximately 297,000 (TA-3-29), 404,900 (TA-16-205), 334,100 (TA-18-168), 271,600 (TA-21-155, -209), 302,000 (TA-50-69), 343,100 (TA-54-38, DVRS, Domes), 301,900 (TA-55-4).

5.12.2 Facility Hazardous Chemical Impacts

5.12.2.1 No Action Alternative

The chemicals of concern at LANL facilities under the No Action Alternative are shown in **Table 5–62**. These have been selected from a database of chemicals used onsite based on their quantities, chemical properties and human health effects. The table shows the Emergency Response Planning Guideline (ERPG) values. ERPG-2 and ERPG-3 values are the concentrations which, if an accident were to occur, could result in serious health affects or life-threatening implications for exposed individuals.

Table 5–62 also shows the risk of worker and public exposure in the event of a chemical release. The cause of a release could be mechanical failure, corrosion, mechanical impact, or natural phenomena. (Chemical releases from site-wide events, that is, Seismic and Wildfire, are discussed in their respective sections.) The estimated frequency of each accident is shown in the table. The direction traveled by the chemical plume, which is dependent upon meteorological conditions at the time of the accident, would determine what segment of the worker and offsite populations would be at risk of exposure.

Table 5–62 Chemical Accident Risks under the No Action Alternative

Chemical	*Frequency (per year)*	*Quantity Released*	*ERPG-2* [a]		*ERPG-3* [b]	
			Value (ppm)	*Annual Risk*	*Value (ppm)*	*Annual Risk*
Selenium hexafluoride from waste cylinder storage at TA-54-216	0.0041	19.8 gallons (75 liters)	0.6 [c]	1 chance in 240 years of workers or public within 3,062 yards (2,800 meters) of facility receiving exposures in excess of limit. Public access is at 537 yards (491 meters).	5.0 [c]	1 chance in 240 years of workers or public within 962 yards (880 meters) of facility receiving exposures in excess of limit. Nearest public access is at 537 yards (491 meters).
Sulfur dioxide from waste cylinder storage at TA-54-216	0.00051	300 pounds (136 kilograms)	3	1 chance in 1,950 years of workers or public within 1,804 yards (1,650 meters) of facility receiving exposures in excess of limit. Public access is at 537 yards (491 meters).	15	1 chance in 1,950 years of workers or public within 755 yards (690 meters) of facility receiving exposures in excess of limit. Nearest public access is at 537 yards (491 meters).
Chlorine gas released outside of Plutonium Facility Complex (TA-55-4)	0.063	150 pounds (68 kilograms)	3	1 chance in 15 years of workers within 1,181 yards (1,080 meters) of facility receiving exposures in excess of limit. Public access is at 1,111 yards (1,016 meters).	20	1 chance in 15 years of workers within 416 yards (380 meters) of facility receiving exposures in excess of limit. Nearest public access is at 1,111 yards (1,016 meters).
Helium at TA-55-41	0.063	9,230,000 cubic feet (at STP)	280,000 ppm [c]	1 chance in 15 years of workers within 215 yards (197 meters) of facility receiving exposures in excess of limit. Public access is at 1,146 yards (1,048 meters).	500,000 ppm [c]	1 chance in 15 years of workers within 152 yards (139 meters) of facility receiving exposures in excess of limit. Public access is at 1,146 yards (1,048 meters).

ERPG = Emergency Response Planning Guideline, ppm = parts per million, TA = technical area, STP = standard temperature and pressure.

[a] ERPG-2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action (DOE 2005c).

[b] ERPG-3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects (DOE 2005c).

[c] The Temporary Emergency Exposure Limit value is used. ERPGs have not been issued for this substance.

For selenium hexafluoride located at TA-54-216, there is an annual risk of 0.0041 (once in 240 years) that workers and the public within a distance of 962 yards (880 meters) of the release would be exposed to concentrations in excess of ERPG-3 values. The workers and the public within a distance of 3,062 yards (2,800 meters) of the release face the same risk of being exposed to concentrations in excess of ERPG-2 values.

For sulfur dioxide located at TA-54-216, there is an annual risk of 0.00051 (once in 1,950 years) that workers and the public within a distance of 755 yards (690 meters) of the release would be exposed to concentrations in excess of ERPG-3 values. The workers and the public within a distance of 1,804 yards (1,650 meters) of the release face the same risk of being exposed to concentrations in excess of ERPG-2 values.

For chlorine gas located outside of TA-55-4, there is an annual risk of 0.063 (once in 15 years) that workers within a distance of 416 yards (380 meters) of the release would be exposed to concentrations in excess of ERPG-3 values. Workers and the public within a distance of 1,181 yards (1,080 meters) of the release face the same risk of being exposed to concentrations in excess of ERPG-2 values.

5.12.2.2 Reduced Operations Alternative

The chemicals of concern that could be released in a facility accident are the same for the Reduced Operations Alternative as for the No Action Alternative. None of the chemicals identified for the latter are eliminated in this alternative. The information in Table 5–62, then, is also applicable to the Reduced Operations Alternative.

5.12.2.3 Expanded Operations Alternative

The chemicals of concern that could be released in a facility accident for the No Action Alternative apply equally to the Expanded Operations Alternative. In addition, MDA cleanup is a component of the Expanded Operations Alternative for which the potential for accidental releases of toxic chemicals exists. Like the scenario for radionuclide release during this operation, an explosion during excavation which breaches any MDA enclosure and bypasses the HEPA filtration was chosen for analysis. There is a great deal of uncertainty as to how much and which chemicals were disposed of in the MDAs; the MDA closest to the public (and thus with the potential for the greatest impact on the public), MDA B, was chosen to conservatively represent the chemical accident impacts for MDA cleanup. Two chemicals, sulfur dioxide (a gas) and beryllium (assumed to be in powder form), were chosen based on their restrictive ERPG values to bound the impacts of an extensive list of possible chemicals disposed of in the MDAs. **Table 5–63** shows that both of these chemicals, if present in MDA B in the quantities assumed, would dissipate to below the ERPG-3 value very close to the release but would continue to represent a risk to the public due to the short distance to the nearest public access point for this MDA. Appendix I includes more details about MDA cleanup chemical accident impacts.

5.12.3 Site-Wide Seismic Impacts

Two site-wide seismic events, referred to as Seismic 01 and Seismic 02, were postulated to estimate the effects of potential radiological and chemical releases. In the event of a site-wide seismic event, both radiological and chemical hazardous materials could be simultaneously released. Seismic 01 has an estimated annual frequency of occurrence of 0.001 (about once in 1,000 years); Seismic 02 has an estimated annual frequency of 0.0005 (about once in 2,000 years). Seismic events are categorized by their performance category (PC) which is numbered from PC-0 through PC-4. A higher performance category has a smaller annual frequency of occurrence, but a larger associated ground acceleration. A higher performance

category has more severe consequences and requires a more robust engineering design to survive. The number of LCFs calculated for these two postulated seismic events should be considered within the context of nonradiological human health impacts expected from these seismic events.

Table 5–63 Chemical Accident Impacts under the Expanded Operations Alternative

Chemical	Frequency (per year)	Quantity Released	ERPG-2 [a]		ERPG-3 [b]	
			Value	Annual Risk	Value	Annual Risk
Selenium hexafluoride from waste cylinder storage at TA-54-216	0.0041	19.8 gallons (75 liters)	0.6 ppm [c]	1 chance in 240 years of workers or public within 3,062 yards (2,800 meters) of facility receiving exposures in excess of limit. Public access is at 537 yards (491 meters).	5 ppm [c]	1 chance in 240 years of workers or public within 962 yards (880 meters) of facility receiving exposures in excess of limit. Nearest public access is at 537 yards (491 meters).
Sulfur dioxide from waste cylinder storage at TA-54-216	0.00051	300 pounds (136 kilograms)	3 ppm	1 chance in 1,950 years of workers or public within 1,804 yards (1,650 meters) of facility receiving exposures in excess of limit. Public access is at 537 yards (491 meters).	15 ppm	1 chance in 1,950 years of workers or public within 755 yards (690 meters) of facility receiving exposures in excess of limit. Nearest public access is at 537 yards (491 meters).
Chlorine gas released outside of Plutonium Facility Complex (TA-55-4)	0.063	150 pounds (68 kilograms)	3 ppm	1 chance in 15 years of workers within 1,181 yards (1,080 meters) of facility receiving exposures in excess of limit. Public access is at 1,111 yards (1,016 meters).	20 ppm	1 chance in 15 years of workers within 416 yards (380 meters) of facility receiving exposures in excess of limit. Nearest public access is at 1,111 yards (1,016 meters).
Sulfur Dioxide (MDA B)	No frequency established; performed as an enveloping analysis	1 pound (0.45 kilogram)	3 ppm	Risk of workers or public within 90 yards (83 meters) of facility receiving exposures in excess of limit. Nearest public access is at 49 yards (45 meters).	15 ppm	Risk of workers or public within 37 yards (34 meters) of facility receiving exposures in excess of limit. Nearest public access is at 49 yards (45 meters).
Beryllium Powder (MDA B)	No frequency established; performed as an enveloping analysis	22 pounds [d] (10 kilograms)	0.025 mg/m^3	Risk of workers within 25 yards (23 meters) of facility receiving exposures in excess of limit. Public access is at 49 yards (45 meters).	0.1 mg/m^3	Risk of workers within 10 yards (9 meters) of facility receiving exposures in excess of limit. Nearest public access is at 49 yards (45 meters) and beyond this limit.

ERPG = Emergency Response Planning Guideline, TA = technical area, ppm = parts per million, MDA = material disposal area, mg/m^3 = milligram per cubic meter.

[a] ERPG-2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action (DOE 2005c).

[b] ERPG-3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects (DOE 2005c).

[c] The Temporary Emergency Exposure Limit value is used. ERPGs have not been issued for this substance.

[d] This quantity represents the total material at risk. A fraction of this solid (0.00006) would be released as respirable particles under the hypothesized scenario.

These seismic events would cause widespread failures of non-nuclear LANL structures and structures outside of LANL. A much larger number of fatalities and injuries from structure collapse would be expected for these seismic events in the area surrounding LANL. Additional details on potential site-wide seismic impacts are provided in Appendix D.

5.12.3.1 No Action Alternative

Site-Wide Seismic 01 – Radiological

Site-Wide Seismic 01 is represented by a PC-2 seismic event. Referring to **Tables 5–64** through **5–66**, and noting that all the listed facilities could contribute to offsite population impacts, the facility with generally the highest contribution to worker and public risk is TA-3-29 (CMR). In the event of this seismic event, it is estimated that there would be 3.65 LCFs in the offsite population from the CMR release. It is likely that a noninvolved worker located 109 yards (100 meters) from the facility would, as a result of this release, contract a fatal latent cancer during his or her lifetime. Since the annual probability of this seismic event is 0.001, the risk of additional LCFs for this accident is estimated at 0.0037 per year in the offsite population. The increased risk of an LCF for the noninvolved worker is estimated at 0.0023 per year or approximately 1 chance in 435. There is potential for an individual at publicly accessible Diamond Drive, approximately 50 meters from CMR, to receive an exposure from that facility in excess of the MEI exposure. The calculated dose to such an individual is 6,400 rem, 100 times the CMR MEI dose. If an individual were at the Diamond Drive location, unprotected, for the duration of the CMR release, he or she would likely contract a fatal cancer during his lifetime.

Table 5–64 Site-Wide Seismic 01 Radiological Accident Offsite Population Consequences for the No Action Alternative

	Maximally Exposed Individual		*Population to 50 Miles (80 kilometers)*	
Facility Impacted by Seismic 01 Event	*Dose (rem)*	*Latent Cancer Fatality Risk* [a]	*Dose (person-rem)*	*Latent Cancer Fatalities* [b, c]
TA-3-29 (CMR)	62	0.074	6,080	3.65
TA-18-168 (SHEBA)	0.0301	0.0000181	0.770	0.000462
TA-21-155 (TSTA)	0.00146	8.76×10^{-7}	0.0492	0.0000295
TA-21-209 (TSFF)	0.0125	7.5×10^{-6}	0.433	0.00026
TA-50-1 (RLWTF)	3.02	0.00181	515	0.309
TA-54-38 (RANT)	64.2	0.077	1,120	0.672
TA-55-185 (Storage Shed)	5.98	0.00359	589	0.353
TA-54-412 (DVRS)	2.76	0.00166	49.1	0.0295
	Max 64.2	Max 0.077	Total 8,354	Total 5.01

TA = technical area, CMR = Chemistry and Metallurgy Research Building, SHEBA = Solution High-Energy Burst Assembly, TSTA = Tritium System Test Assembly, TSFF = Tritium Science and Fabrication Facility, RLWTF = Radioactive Liquid Waste Treatment Facility, RANT = Radioactive Assay and Nondestructive Test, DVRS = Decontamination and Volume Reduction System.

[a] Increased risk of an LCF to an individual, assuming the accident occurs.

[b] Increased number of LCFs for the offsite population, assuming the accident occurs.

[c] Offsite population size out to a 50-mile (80-kilometer) radius is approximately 297,000 (TA-3-29), 334,100 (TA-18-168), 271,600 (TA-21-155, -209), 302,000 (TA-50-1), 343,100 (TA-54-38, DVRS).

Table 5–65 Site-Wide Seismic 01 Radiological Accident Onsite Worker Consequences for the No Action Alternative

Facility Impacted by Seismic 01 Event	Noninvolved Worker at 109 Yards (100 meters)	
	Dose (rem)	Latent Cancer Fatality Risk [a]
TA-3-29 (CMR)	1,940	1.00 [b]
TA-18-168 (SHEBA)	1.06	0.000636
TA-21-155 (TSTA)	0.0111	6.66×10^{-6}
TA-21-209 (TSFF)	0.0974	0.0000584
TA-50-1 (RLWTF)	121	0.145
TA-54-38 (RANT)	576	0.691
TA-55-185 (Storage Shed)	239	0.287
TA-54-412 (DVRS)	10.1	0.00606

TA = technical area, CMR = Chemistry and Metallurgy Research Building, SHEBA = Solution High-Energy Burst Assembly, TSTA = Tritium System Test Assembly, TSFF = Tritium Science and Fabrication Facility, RLWTF = Radioactive Liquid Waste Treatment Facility, RANT = Radioactive Assay and Nondestructive Test, DVRS = Decontamination and Volume Reduction System.

[a] Increased risk of an LCF to an individual, assuming the accident occurs.

[b] The indicated dose yields a risk value greater than 1.00. This means that it is likely that an individual exposed to the indicated dose would contract a fatal latent cancer in their lifetime. For this reason a value of 1.00 is shown.

Table 5–66 Site-Wide Seismic 01 Radiological Accident Offsite Population and Worker Risks for the No Action Alternative

Facility Impacted by Seismic 01 Event	Frequency (per year)	Onsite Worker	Offsite Population	
		Risk to Noninvolved Worker at 109 Yards (100 meters) [a]	Risk to Maximally Exposed Individual [a]	Latent Cancer Fatalities [b, c]
TA-3-29 (CMR)	0.001	0.001	0.0000744	0.00365
TA-18-168 (SHEBA)	0.001	6.36×10^{-7}	1.81×10^{-8}	4.62×10^{-7}
TA-21-155 (TSTA)	0.001	6.66×10^{-9}	8.76×10^{-10}	2.95×10^{-8}
TA-21-209 (TSFF)	0.001	5.84×10^{-8}	7.50×10^{-9}	2.6×10^{-7}
TA-50-1 (RLWTF)	0.001	0.000145	1.81×10^{-6}	0.000309
TA-54-38 (RANT)	0.001	0.000691	0.0000770	0.000672
TA-55-185 (Storage Shed)	0.001	0.000287	3.59×10^{-6}	0.000353
TA-54-412 (DVRS)	0.001	6.06×10^{-6}	1.66×10^{-6}	0.0000295
		Maximum 0.00233	Maximum 0.000077	Total 0.00501

TA = technical area, CMR = Chemistry and Metallurgy Research Building, SHEBA = Solution High-Energy Burst Assembly, TSTA = Tritium System Test Assembly, TSFF = Tritium Science and Fabrication Facility, RLWTF = Radioactive Liquid Waste Treatment Facility, RANT = Radioactive Assay and Nondestructive Test, DVRS = Decontamination and Volume Reduction System.

[a] Increased risk of an LCF to an individual per year.

[b] Increased number of LCFs for the offsite population per year.

[c] Offsite population size out to a 50-mile (80-kilometer) radius is approximately 297,000 (TA-3-29), 334,100 (TA-18-168), 271,600 (TA-21-155, -209), 302,000 (TA-50-1), 343,100 (TA-54-38, DVRS).

All site facilities containing hazardous radiological materials which are susceptible to structural failure during this event could potentially contribute to the exposure of LANL workers and the public in the event of a site-wide seismic event. As a result, the worker and population risks given in Table 5–66 can be summed as shown to provide a meaningful estimate of worker and public impacts. The individual risks to the MEI and noninvolved worker cannot be summed, because the risk at a specific location depends on the meteorology during the event; the direction that the wind carries the release from each facility would not impact one location in the same manner for multiple accidents at the same time. As a result, Table 5–66 shows the maximum risk of the individual receptors. The total impact to these individuals could be somewhat greater than indicated if more than one release affects these locations. Table 5–66 only provides estimated impacts for facilities with the highest potential impacts. If all facilities were taken into account the summation of offsite population impacts from all LANL facilities with radiological materials would be somewhat higher.

Site-Wide Seismic 02 – Radiological

Site-Wide Seismic 02 is represented by a PC-3 seismic event. Referring to **Tables 5–67** through **5–69**, and noting that all the listed facilities could contribute to offsite population impacts, the facility with the highest contribution to public consequence are the waste storage domes in TA-54 holding transuranic waste. In the event of this seismic event, it is estimated that there would be 4.46 LCFs in the offsite population from this TA-54 release. This same facility would result in the highest contribution to MEI radiological consequence. The MEI located at the nearest site boundary and a noninvolved worker located 109 yards (100 meters) from the facility would, as a result of this release, have a strong likelihood of contracting a fatal cancer sometime during their lifetimes (greater than 1 chance in 2). Since the annual probability of this large seismic event is 1 in 2,000 years (0.0005), the risk of additional LCFs from this TA-54 release is estimated at 0.00223 per year in the offsite population. The increased risk of an LCF for the MEI and noninvolved worker are estimated at 1 chance in 260 (0.00384) per year and 1 chance in 775 (0.00129) per year, respectively. The next highest risk of an LCF to the general population and the noninvolved worker are from CMR releases.

All site facilities containing hazardous radiological materials that are susceptible to structural failure during this event could potentially contribute to the exposure of LANL workers and the public in the event of a site-wide seismic event. As a result, the worker and offsite population risks given in Table 5–69 can be summed as shown to provide a meaningful estimate of worker and public impacts. The individual risks to the MEI and noninvolved worker cannot be summed because the risk at a specific location depends on the meteorology during the event; the direction that the wind carries the release from each facility would not impact one location in the same manner for multiple accidents at the same time. As a result, Table 5–69 shows the maximum risk of the individual receptors. The total impact to these individuals could be somewhat greater than indicated if more than one release affects these locations. Table 5–69 only provides estimated impacts for facilities with the highest potential impacts. If all facilities were taken into account, the summation of worker and offsite population risks from all LANL facilities with radiological materials could be somewhat higher.

Table 5–67 Site-Wide Seismic 02 Radiological Accident Offsite Population Consequences for the No Action Alternative

Facility Impacted by Seismic 02 Event	Maximally Exposed Individual		Population to 50 Miles (80 kilometers)	
	Dose (rem)	Latent Cancer Fatality Risk [a]	Dose (person-rem)	Latent Cancer Fatalities [b, c]
TA-3-29 (CMR)	62	0.0744	6,080	3.65
TA-16-205 (WETF)	6.43	0.00386	159	0.0952
TA-18-168 (SHEBA)	0.0301	0.0000181	0.770	0.000462
TA-21-155 (TSTA)	0.00146	8.76×10^{-7}	0.0492	0.0000295
TA-21-209 (TSFF)	0.0125	7.5×10^{-6}	0.433	0.000260
TA-50-1 (RLWTF)	3.02	0.00181	515	0.309
TA-50-69 (WCRR)	2.84	0.00170	237	0.142
TA-54-38 (RANT)	64.2	0.0770	1,120	0.672
TA-55-4 (Plutonium Facility)	4.21	0.00253	403	0.242
TA-55-185 (Storage Facility)	5.98	0.00359	589	0.353
TA-54-412 (DVRS)	33.7	0.0404	601	0.361
TA-54 (Waste Storage Domes)	462	0.554	7,430	4.46
TA-55-355 (SST Facility)	3.94	0.00236	294	0.176
	Max 462	Max 0.554	Total 17,429	Total 10.46

TA = technical area, CMR = Chemistry and Metallurgy Research Building, WETF = Weapons Engineering Tritium Facility, SHEBA = Solution High-Energy Burst Assembly, TSTA = Tritium System Test Assembly, TSFF = Tritium Science and Fabrication Facility, RLWTF = Radioactive Liquid Waste Treatment Facility, WCRR = Waste Characterization, Reduction, and Repackaging Facility, RANT = Radioactive Assay and Nondestructive Test, DVRS = Decontamination and Volume Reduction System, SST = Safe, Secure Transport.

[a] Increased risk of an LCF to an individual per year.

[b] Increased number of LCFs for the offsite population per year.

[c] Offsite population size out to a 50-mile (80-kilometer) radius is approximately 297,000 (TA-3-29), 404,900 (TA-16-205), 334,100 (TA-18-168), 271,600 (TA-21-155, -209), 302,000 (TA-50-1, -69), 343,100 (TA-54-38, DVRS, Domes), 301,900 (TA-55-4, -185, -355).

Site-Wide Seismic 01 – Chemical

The facilities and chemicals of concern under site-wide Seismic 01 conditions are shown in Table 5–70. There are numerous chemicals in small quantities onsite that may be released under these conditions. The listed chemicals have been selected from a complete set of chemicals used onsite, based on their larger quantities, chemical properties, and human health effects. Exposure to concentrations in excess of the ERPG values could result in serious health effects or life-threatening implications to the exposed individuals.

Table 5–70 also shows the estimated annual risks for workers and the public in the event of an accidental release for each chemical. The annual frequency of this accident is 0.001 per year. Since this accident is a site-wide seismic event, all the chemicals shown in the table would be released almost simultaneously. The annual risk of exposure to workers and the public to chemical concentrations in excess of ERPG-2 and ERPG-3 values is 1 chance in 1,000 per year. The nearest public access relative to each facility is shown for each chemical. For some chemicals, the nearest public access point is beyond the distance at which concentrations would be at ERPG values. In these instances, there would likely be no serious health affects to the public in the event of an accident. For formaldehyde, as shown in Table 5–70, the nearest public

access point is closer than the distance at which concentrations would be at the ERPG values. If this accident were to occur, members of the public could be exposed to harmful and possibly fatal concentrations of formaldehyde.

Table 5–68 Site-Wide Seismic 02 Radiological Accident Onsite Worker Consequences for the No Action Alternative

Facility Impacted by Seismic 02 Event	*Noninvolved Worker at 109 Yards (100 meters)*	
	Dose (rem)	*Latent Cancer Fatality Risk* [a]
TA-3-29 (CMR)	1,940	1.00 [b]
TA-16-205 (WETF)	5.86	0.00352
TA-18-168 (SHEBA)	1.06	0.000636
TA-21-155 (TSTA)	0.0111	6.66×10^{-6}
TA-21-209 (TSFF)	0.0974	0.0000584
TA-50-1 (RLWTF)	121	0.145
TA-50-69 (WCRR)	129	0.155
TA-54-38 (RANT)	576	0.691
TA-55-4 (Plutonium Facility)	47.9	0.0575
TA-55-185 (Storage Shed)	239	0.287
TA-54-412 (DVRS)	123	0.148
TA-54 (Waste Storage Domes)	2,150	1.00 [b]
TA-55-355 (SST Facility)	129	0.155

TA = technical area, CMR = Chemistry and Metallurgy Research Building, WETF = Weapons Engineering Tritium Facility, SHEBA = Solution High-Energy Burst Assembly, TSTA = Tritium System Test Assembly, TSFF = Tritium Science and Fabrication Facility, RLWTF = Radioactive Liquid Waste Treatment Facility, WCRR = Waste Characterization, Reduction, and Repackaging Facility, RANT = Radioactive Assay and Nondestructive Test, DVRS = Decontamination and Volume Reduction System, SST = Safe, Secure Transport.

[a] Increased risk of an LCF to an individual, assuming the accident occurs.

[b] The indicated dose yields a risk value greater than 1.00. This means that it is likely that an individual exposed to the indicated dose would contract a fatal latent cancer in their lifetime. For this reason a value of 1.00 is shown.

Site-Wide Seismic 02 - Chemical

The facilities and chemicals of concern under site-wide Seismic 02 conditions are shown in **Table 5–71**. There are numerous chemicals in small quantities onsite that could be released under these conditions. The listed chemicals have been selected from a complete set of chemicals used onsite based on their larger quantities, chemical properties, and human health effects.

Table 5–71 also shows the estimated annual risks for workers and the public in the event of an accidental release for each chemical. The annual frequency of this accident is 0.0005 per year. Since this accident is a site-wide seismic event, all the chemicals shown in the table would be released almost simultaneously. The annual risk of exposure to workers and the public to chemical concentrations in excess of ERPG-2 and ERPG-3 values is one chance in 2,000 per year. The nearest public access relative to each facility is shown for each chemical. For some chemicals, the nearest public access point is beyond the distance at which concentrations would be at ERPG values. In these instances, there would likely be no serious health affects to the public in the event of an accident. For formaldehyde at the Bioscience Facilities and chlorine gas at the Plutonium Facility Complex, as shown in Table 5–71, the nearest public access points are closer than the distance at which concentrations would be at the ERPG values. If these accidents

were to occur, members of the public could be exposed to harmful and possibly fatal concentrations of these chemicals.

Table 5–69 Site-Wide Seismic 02 Radiological Accident Offsite Population and Worker Risks for the No Action Alternative

Facility Impacted by Seismic 02 Event	*Frequency (per year)*	*Onsite Worker*	*Offsite Population*	
		Risk to Noninvolved Worker at 109 Yards (100 meters) [a]	*Risk to Maximally Exposed Individual* [a]	*Latent Cancer Fatalities* [b, c]
TA-3-29 (CMR)	0.0005	0.0005	0.0000372	0.00182
TA-16-205 (WETF)	0.0005	1.76×10^{-6}	1.93×10^{-6}	0.0000476
TA-18-168 (SHEBA)	0.0005	3.18×10^{-7}	9.03×10^{-9}	2.31×10^{-7}
TA-21-155 (TSTA)	0.0005	3.33×10^{-9}	4.38×10^{-10}	1.48×10^{-8}
TA-21-209 (TSFF)	0.0005	2.92×10^{-8}	3.75×10^{-9}	1.30×10^{-7}
TA-50-1 (RLWTF)	0.0005	0.0000726	9.06×10^{-7}	0.000155
TA-50-69 (WCRR)	0.0005	0.0000774	8.52×10^{-7}	0.0000711
TA-54-38 (RANT)	0.0005	0.000346	0.0000385	0.000336
TA-55-4 (Plutonium Facility)	0.0005	0.0000287	1.26×10^{-6}	0.000121
TA-55-185 (Storage Shed)	0.0005	0.000143	1.79×10^{-6}	0.000177
TA-54-412 (DVRS)	0.0005	0.0000738	0.0000202	0.000180
TA-54 (Waste Storage Domes)	0.0005	0.0005	0.000277	0.00223
TA-55-355 (SST Facility)	0.0005	0.0000774	1.18×10^{-6}	0.0000882
		Maximum 0.00129	Maximum 0.000277	Total 0.00523

TA = technical area, CMR = Chemistry and Metallurgy Research Building, WETF = Weapons Engineering Tritium Facility, SHEBA = Solution High-Energy Burst Assembly, TSTA = Tritium System Test Assembly, TSFF = Tritium Science and Fabrication Facility, RLWTF = Radioactive Liquid Waste Treatment Facility, WCRR = Waste Characterization, Reduction, and Repackaging Facility, RANT = Radioactive Assay and Nondestructive Test, DVRS = Decontamination and Volume Reduction System, SST = Safe, Secure Transport.

[a] Increased risk of an LCF to an individual per year.

[b] Increased number of LCFs for the offsite population per year.

[c] Offsite population size out to a 50-mile (80-kilometer) radius is approximately 297,000 (TA-3-29), 404,900 (TA-16-205), 334,100 (TA-18, -168), 271,600 (TA-21-155, -209), 302,000 (TA-50-1, -69), 343,100 (TA-54-38, DVRS, Domes), 301,900 (TA-55-4, -185, -355).

5.12.3.2 Reduced Operations Alternative

The site-wide Seismic 01 and 02 radiological accident impacts from the Reduced Operations Alternative are similar to those from the No Action Alternative as given in Tables 5–64 through 5–69. Activities at TA-18 including operation of SHEBA would cease under this alternative. SHEBA operations are a small component of the site-wide seismic accident impacts at LANL; its elimination would not significantly alter the overall site risk profile from such an event. All other impacts in the tables are equally applicable for this alternative.

Site-Wide Seismic 01 and 02 – Chemical

The chemicals of concern that could be released in a site-wide Seismic 01 or 02 event are the same for the Reduced Operations Alternative as for the No Action Alternative. None of the chemicals identified for the latter are eliminated in this alternative. The information in Tables 5–70 and 5–71, then, is applicable to the Reduced Operations Alternative.

Table 5–70 Chemical Accident Risks under Seismic 01 Conditions

Chemical	Frequency (per year)	Quantity Released	ERPG-2 [a]		ERPG-3 [b]	
			Value (ppm)	Annual Risk	Value (ppm)	Annual Risk
Hydrogen cyanide at TA-3-66 (Sigma Complex)	0.001	13.5 pounds (6.1 kilograms)	10	1 chance in 1,000 years of workers within 153 yards (140 meters) of facility receiving exposures in excess of limit. Nearest public access is at 260 yards (238 meters).	25	1 chance in 1,000 years of workers within 94 yards (86 meters) of facility receiving exposures in excess of limit. Nearest public access is at 260 yards (238 meters).
Phosgene at TA-9-21	0.001	1 pound (0.45 kilograms)	0.2	1 chance in 1,000 years of workers within 306 yards (280 meters) of facility receiving exposures in excess of limit. Nearest public access is at 900 yards (823 meters).	1	1 chance in 1,000 years of workers within 131 yards (120 meters) of facility receiving exposures in excess of limit. Nearest public access is at 900 yards (823 meters).
Formalde-hyde at TA-43-1 (Bioscience Facilities)	0.001	3.7 gallons (14.1 liters)	10	1 chance in 1,000 years of workers or public within 197 yards (180 meters) of facility receiving exposures in excess of limit. Nearest public access is at 13 yards (12 meters).	25	1 chance in 1,000 years of workers or public within 120 yards (110 meters) of facility receiving exposures in excess of limit. Nearest public access is at 13 yards (12 meters).

ERPG = Emergency Response Planning Guideline, ppm = parts per million, TA = technical area.

[a] ERPG-2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action (DOE 2005c).

[b] ERPG-3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects (DOE 2005c).

Table 5–71 Chemical Accident Risks under Seismic 02 Conditions

Chemical	Frequency (per year)	Quantity Released	ERPG-2 [a]		ERPG-3 [b]	
			Value (ppm)	Annual Risk	Value (ppm)	Annual Risk
Hydrogen cyanide at TA-3-66 (Sigma)	0.0005	13.5 pounds (6.1 kilograms)	10	1 chance in 2,000 years of workers within 153 yards (140 meters) of facility receiving exposures in excess of limit. Nearest public access is at 260 yards (238 meters).	25	1 chance in 2,000 years of workers within 94 yards (86 meters) of facility receiving exposures in excess of limit. Nearest public access is at 260 yards (238 meters).
Phosgene at TA-9-21	0.0005	1 pound (0.45 kilograms)	0.2	1 chance in 2,000 years of workers within 306 yards (280 meters) of facility receiving exposures in excess of limit. Public access is at 900 yards (823 meters).	1	1 chance in 2,000 years of workers within 131 yards (120 meters) of facility receiving exposures in excess of limit. Public access is at 900 yards (823 meters).

Chemical	Frequency (per year)	Quantity Released	ERPG-2 [a]		ERPG-3 [b]	
			Value (ppm)	Annual Risk	Value (ppm)	Annual Risk
Formaldehyde at TA-43-1 (Bioscience Facilities)	0.0005	3.7 gallons (14.1 liters)	10	1 chance in 2,000 years of workers or public within 197 yards (180 meters) of facility receiving exposures in excess of limit. Nearest public access is at 13 yards (12 meters).	25	1 chance in 2,000 years of workers or public within 120 yards (110 meters) of facility receiving exposures in excess of limit. Nearest public access is at 13 yards (12 meters).
Chlorine gas released outside of Plutonium Facility Complex (TA-55-4)	0.0005	150 pounds (68 kilograms)	3	1 chance in 2,000 years of workers within 1,181 yards (1,080 meters) of facility receiving exposures in excess of limit. Public access is at 1,111 yards (1,016 meters).	20	1 chance in 2,000 years of workers within 416 yards (380 meters) of facility receiving exposures in excess of limit. Public access is at 1,111 yards (1,016 meters).
Nitric acid spill at Plutonium Facility Complex (TA-55-4)	0.0005	6,100 gallons (23,091 liters)	6	1 chance in 2,000 years of workers within 53.6 yards (49 meters) of facility receiving exposures in excess of limit. Nearest public access is at 1,111 yards (1,016 meters).	78	1 chance in 2,000 years of workers within 7.2 yards (6.6 meters) of facility receiving exposures in excess of limit. Nearest public access is at 1,111 yards (1,016 meters).
Hydrochloric acid spill at TA-55-249	0.0005	5,200 gallons (19,684 liters)	20	1 chance in 2,000 years of workers or public within 220 yards (185 meters) of facility receiving exposures in excess of limit. Nearest public access is at 1,221 yards (1,117 meters).	150	1 chance in 2,000 years of workers or public within 70 yards (64 meters) of facility receiving exposures in excess of limit. Nearest public access is at 1,221 yards (1,117 meters).

ERPG = Emergency Response Planning Guideline, ppm = parts per million, TA = technical area.

[a] ERPG-2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action (DOE 2005c).

[b] ERPG-3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects (DOE 2005c).

5.12.3.3 Expanded Operations Alternative

The Seismic 01 and 02 accident impacts from the Expanded Operations Alternative are similar to those from the No Action Alternative, shown in Tables 5–64 through 5–69. SHEBA operations would cease for the Expanded Operations Alternative. Since its impacts are relatively small, deleting this accident does not change the overall risk profile of this alternative. Additional accident risks would result from expanded waste management activities. Transuranic waste storage would be consolidated in a new facility, the Transuranic Waste Consolidation Facility, located in TA-50 or TA-63. The impacts from this new facility would be less than those of the existing facility because of the new location and because less material would be stored onsite. The entries in Tables 5–64 through 5–69 reflect present DVRS operations because it would be active for most of the time period of interest. Present accident impacts bound the impacts of the replacement facility. Accident impacts for the new facility are described in Appendix H.

Site-Wide Seismic 01 and 02 – Chemical

The chemicals of concern that could be released in a site-wide Seismic 01 or 02 event are the same for the Expanded Operations Alternative as for the No Action Alternative. No additional chemicals were identified in this alternative that would have impacts exceeding those for No Action. The information in Tables 5–70 and 5–71, then, are applicable to the Expanded Operations Alternative.

5.12.4 Wildfire Accident Impacts

A wildfire accident scenario was postulated for evaluation of potential impacts to onsite workers and the offsite population. Details for these scenarios are provided in Appendix D including the LANL buildings that could be affected by the wildfire, inventory of hazardous radiological materials, source term factors and the estimated source terms.

5.12.4.1 Radiological

The estimated consequences for workers and the public as a result of a wildfire are shown in **Tables 5–72** and **5–73** for each listed facility. The values shown assume that a wildfire has occurred and therefore do no reflect any credit for the probability of a wildfire occurrence. The estimated annual risks for each wildfire scenario are shown in **Table 5–74**. These values take credit for the probability of a wildfire's occurrence.

Table 5–72 Radiological Accident Offsite Population Consequences for a Wildfire Accident

Facility Impacted by Wildfire	*Maximally Exposed Individual*		*Population to 50 Miles (80 kilometers)*	
	Dose (rem)	*Latent Cancer Fatality Risk* [a]	*Dose (person-rem)*	*Latent Cancer Fatalities* [b, c]
TA-03-66/451 (Sigma Complex)	0.00389	2.33×10^{-6}	4.75	0.00285
TA-16-205 (WETF)	0.0605	0.0000363	112	0.0673
TA-48-1 (Radiochemistry Facility)	0.00107	6.42×10^{-7}	0.436	0.000262
TA-54 (Waste Storage Domes)	1,930	1.00 [d]	91,300	54.8
TA-16-411 (Device Assembly)	1.48×10^{-6}	8.88×10^{-10}	0.000174	1.04×10^{-7}
TA-54-412 (DVRS)	4.91	0.00295	1,160	0.696
TA-8-23 (Radiography)	0.000332	1.99×10^{-7}	0.562	0.000337

TA = technical area, WETF = Weapons Engineering Tritium Facility, DVRS = Decontamination and Volume Reduction System.

[a] Increased risk of an LCF to an individual, assuming the accident occurs.

[b] Increased number of LCFs for the offsite population, assuming the accident occurs.

[c] Offsite population size is approximately 297,030 for TA-03-66/451; 404,913 for TA-16-205 and TA-16-411; 299,508 for TA-48-01; 343,069 for Waste Storage Dome and DVRS; and 349,780 for TA-8-23.

[d] The indicated dose yields a risk greater than 1.00. This means that it is likely than an individual exposed to the indicated dose would contract a fatal latent cancer in their lifetime. For this reason a value of 1.00 is shown.

As shown in Table 5–72, the results indicate that radiological releases from the TA-54 waste storage domes dominate the impacts to workers and the public. In the event of this accident, the consequence to the MEI is a likelihood of developing a fatal cancer, during his or her lifetime and for the population, an additional 54.8 LCFs. As shown in Table 5–73, an onsite worker

located 109 yards (100 meters) from the facility would be likely to contract a fatal cancer during his or her lifetime as a result of this accident at TA-54.

Table 5–73 Radiological Accident Onsite Worker Consequences for a Wildfire Accident

Accident	*Noninvolved Worker at 109 Yards (100 meters)*	
	Dose (rem)	*Latent Cancer Fatality Risk* [a]
TA-03-66/451 (Sigma Complex)	0.0759	0.0000455
TA-16-205 (WETF)	0.333	0.00020
TA-48-1 (Radiochemistry Facility)	0.0155	9.30×10^{-6}
TA-54 (Waste Storage Domes)	8,730	1.00 [b]
TA-16-411 (Device Assembly)	0.0000173	1.04×10^{-8}
TA-54-412 (DVRS)	16.4	0.00984
TA-8-23 (Radiography)	0.00191	1.15×10^{-6}

TA = technical area, WETF = Weapons Engineering Tritium Facility, DVRS = Decontamination and Volume Reduction System.

[a] Increased risk of an LCF to an individual, assuming the accident occurs.

[b] The indicated dose yields a risk greater than 1.00. This means that it is likely than an individual exposed to the indicated dose would contract a fatal latent cancer in their lifetime. For this reason a value of 1.00 is shown.

Table 5–74 Radiological Accident Offsite Population and Worker Risks for a Wildfire Accident

Accident	*Frequency (per year)*	*Onsite Worker*	*Offsite Population*	
		Risk to Noninvolved Worker at 109 Yards (100 meters) [a]	*Risk to Maximally Exposed Individual* [a]	*Latent Cancer Fatality Risk* [b, c]
TA-03-66/451 (Sigma Complex)	0.05	2.28×10^{-6}	1.17×10^{-7}	0.000143
TA-16-205 (WETF)	0.05	9.99×10^{-6}	1.82×10^{-6}	0.00336
TA-48-1 (Radiochemistry Facility)	0.05	4.65×10^{-7}	3.21×10^{-8}	1.31×10^{-5}
TA-54 (Waste Storage Domes)	0.05	0.05	0.05	2.74
TA-16-411 (Device Assembly)	0.05	5.19×10^{-10}	4.44×10^{-11}	5.22×10^{-9}
TA-54-412 (DVRS)	0.05	0.000492	0.000147	0.0348
TA-8-23 (Radiography)	0.05	5.73×10^{-8}	9.96×10^{-9}	1.69×10^{-5}

TA = technical area, WETF = Weapons Engineering Tritium Facility, DVRS = Decontamination and Volume Reduction System.

[a] Increased risk of an LCF to an individual per year.

[b] Increased number of LCFs for the offsite population per year.

[c] Offsite population size is approximately 297,030 for TA-03-66/451; 404,913 for TA-16-205 and TA-16-411; 299,508 for TA-48-01; 343,069 for Waste Storage Dome and DVRS; and 349,780 for TA-8-23.

The risks for this accident, which takes credit for its frequency of occurrence, are estimated to be about a 1 chance in 8.6 (0.116) increased likelihood of an LCF per year for the MEI and an additional 2.7 LCFs per year of operations in the offsite population. An onsite worker located 109 yards (100 meters) from the facility experiences an increased likelihood of an LCF of about 1 chance in 1.9 (0.524) per year of operations. These risks assume that the receptors do not take evasive action in the event of a wildfire. Because the releases from TA-54 domes dominate the consequences and risks from a wildfire, it represents the total impacts on the offsite and worker populations.

5.12.4.2 Chemical

The chemicals of concern at LANL facilities under wildfire conditions are shown in **Table 5–75**. These have been selected from a database of chemicals used onsite based on their quantities, chemical properties, and human health effects. The table shows the ERPG-2 and ERPG-3 values for which, if an accident were to occur, concentrations in excess of these values could result in serious health effects or life-threatening implications for exposed individuals.

Table 5–75 also shows the risk of worker and public exposure in the event of a chemical release. The estimated frequency of each release is shown in the table. The direction traveled by the chemical plume would depend upon meteorological conditions at the time of the accident and would determine what segment of the worker and offsite populations would be at risk of exposure.

Table 5–75 Chemical Accident Impacts under Wildfire Conditions

Chemical	*Frequency (per year)*	*Quantity Released*	*ERPG-2* [a]		*ERPG-3* [b]	
			Value (ppm)	*Annual Risk*	*Value (ppm)*	*Annual Risk*
Formaldehyde at TA-43-1	0.05	3.7 gallons (14.1 liters)	10	1 chance in 20 years of workers or public within 154 yards (141 meters) of facility receiving exposures in excess of limit. Public access is at 13 yards (12 meters).	25	1 chance in 20 years of workers or public within 97 yards (89 meters) of facility receiving exposures in excess of limit. Nearest public access is at 13 yards (12 meters).
Hydrogen cyanide from TA-3-66	0.05	13.5 pounds (6.1 kilograms)	10	1 chance in 20 years of workers within 120 yards (110 meters) of facility receiving exposures in excess of limit. Public access is at 260 yards (238 meters).	25	1 chance in 20 years of workers within 77 yards (70 meters) of facility receiving exposures in excess of limit. Nearest public access is at 260 yards (238 meters).

ERPG = Emergency Response Planning Guideline, ppm= parts per million, TA = technical area.

[a] ERPG-2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action (DOE 2005c).

[b] ERPG-3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects (DOE 2005c).

For formaldehyde at TA-43-1, there is an annual risk of 0.05 (once in 20 years) that workers and public within a distance of 97 yards (89 meters) of the release would be exposed to concentrations in excess of ERPG-3 values. The workers and public within a distance of 154 yards (141 meters) of the release face the same risk of being exposed to concentrations in excess of ERPG-2 values.

For hydrogen cyanide released from TA-3-66, there is an annual risk of 0.05 (once in 20 years) that workers within a distance of 77 yards (70 meters) of the release would be exposed to concentrations in excess of ERPG-3 values. The workers within a distance of 120 yards (110 meters) of the release face the same risk of being exposed to concentrations in excess of ERPG-2 values. There would be no risk that the public would receive an exposure in excess of

ERPG-2 or ERPG-3 values since the nearest public access is 260 yards (238 meters) from the location of this chemical release.

5.12.5 Construction Accidents

The construction of new facilities includes the risk of accidents that could impacts workers. Since construction activities do not involve radioactive materials, there would be no radiological impacts. The presence of hazardous flammable, explosive and other chemical substances could initiate accident conditions that could impact the health and safety of workers. In addition, in the course of their work, construction personnel and site personnel could receive serious or fatal injuries as a result of incidents that are in the category of industrial accidents. DOE's construction contractors are required to adhere to strict safety standards and procedures in order to provide a working environment that minimizes the possibility of such accidents.

5.13 Cumulative Impacts

In accordance with the Council on Environmental Quality (CEQ) regulations, a cumulative impact analysis includes "the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time." (40 CFR 1508.7)

The cumulative impact analysis for this SWEIS includes: (1) an examination of cumulative impacts presented in the *1999 SWEIS*; (2) impacts since the *1999 SWEIS* was issued, presented in this chapter; and (3) a review of past, present and reasonably foreseeable actions for other federal and non-federal agencies in the region.

Reasonably foreseeable future actions that are likely to occur at LANL are described in Section 3.3 under the Expanded Operations Alternative. Additional DOE or NNSA actions potentially impacting LANL include the possible siting of a modern pit facility at LANL, consolidation of nuclear operations related to production of radioisotope power systems; and the conveyance and transfer of land at LANL to Los Alamos County and the Department of the Interior to be held in trust for the San Ildefonso Pueblo. Consolidation of DOE Office of Nuclear Energy, Science and Technology plutonium-238 activities at the Idaho National Laboratory proposed in the *Draft Environmental Impact Statement for the Proposed Consolidation of Nuclear Operations Related to Production of Radioisotope Power Systems* (DOE/EIS-0373D) (*Consolidation EIS*) (DOE 2005b) would reduce plutonium-238 operations at LANL. Regardless of the decision on the *Consolidation EIS*, some plutonium-238 operations would continue at LANL. Therefore, very small changes in the impacts from plutonium-238 activities at LANL would be realized.

If current plutonium-238 operations were to continue at the LANL Plutonium Facility Complex, as described under the *Consolidation EIS* No Action Alternative, manufacturing of up to approximately 50 pits per year (80 pits per year using multiple shift operations) could still be accomplished within the LANL Plutonium Facility Complex. This would be accommodated by consolidating a number of plutonium processing and support activities (such as, analytical

chemistry and materials characterization at the Chemistry and Metallurgy Research Replacement Facility). The impact of the 80-pit-per-year production and plutonium-238 processing (at levels far above the level of plutonium-238 processing identified in the *Consolidation EIS*) has already been evaluated in both the LANL *1999 SWEIS* and this new SWEIS. Therefore, there would be no additional cumulative effect from these activities.

An EIS analyzing the potential environmental impacts of operation of a BSL-3 Facility is in the early stages of preparation; therefore, definitive data for inclusion in the cumulative impacts analysis are not available for this draft SWEIS. However, information about the facility and its potential operations can be evaluated at a general level that is adequate to assess potential contributions to cumulative impacts from facility operation.

The BSL-3 Facility in TA-3 is a single-story 3,200-square foot (300-square meter) stucco building. It houses two BSL-3 laboratories, a BSL-2 laboratory, and support facilities including offices, a locker room, and showers. Construction is complete, but no operations of any type have been conducted in the facility. Operation of this facility is anticipated to result in at most, minimal incremental impacts on all resource areas. Utility use would be minimal; much less than most other LANL facilities and it would not affect LANL's overall utility demand or that of the region. Air emissions would be passed through HEPA filters and would not affect the air quality of the region. Liquid and solid wastes from operational areas would be thermally or chemically destroyed prior to discharge or disposal. Liquid waste would be discharged to the LANL sanitary sewage system where it would be commingled and treated prior to discharge and would have minimal impact on local and regional water quality. No radiological materials would be used at the facility, so no radioactive waste would be generated. Relatively small amounts of other regulated wastes would be generated which would be easily managed within the LANL waste management infrastructure and have negligible impact on transportation.

For the conveyance and transfer of land at LANL to Los Alamos County and the Department of the Interior to be held in trust for the San Ildefonso Pueblo, cumulative impacts were identified in the *Final Environmental Impact Statement for the Conveyance and Transfer of Certain Land Tracts Administered by the U.S. Department of Energy and Located at the Los Alamos National Laboratory, Los Alamos and Santa Fe Counties, New Mexico*, DOE/EIS-0293 (DOE 1999d). Impacts for this action are also included by resource area in earlier sections of this SWEIS.

Primary sources for information on LANL contributions to cumulative impacts, other than the current and *1999 SWEIS*, are listed below:

- *Draft Supplemental Programmatic Environmental Impact Statement on Stockpile Stewardship and Management for a Modern Pit Facility*, DOE/EIS-236-S2 (DOE 2003b)

- *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada*, DOE/EIS-0250 (DOE 2002b)

- *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement*, DOE/EIS-0026-S-2 (DOE 1997b)

- *Environmental Surveillance at Los Alamos during 2004*, LA-14239-ENV (LANL 2005j)

- *Draft Environmental Impact Statement for the Proposed Consolidation of Nuclear Operations Related to Production of Radioisotope Power Systems*, DOE/EIS-0373D (DOE 2005b)

- *Final Environmental Impact Statement for the Conveyance and Transfer of Certain Land Tracts Administered by the U.S. Department of Energy and Located at the Los Alamos National Laboratory, Los Alamos and Santa Fe Counties, New Mexico*, DOE/EIS-0293 (DOE 1999d)

- Notice of Intent to Prepare an Environmental Impact Statement for the Operation of a Biosafety Level 3 Facility at Los Alamos National Laboratory, Los Alamos, New Mexico, 70 FR 228, November 29, 2005

It is also necessary to consider activities implemented by other Federal, state, and local agencies and individuals outside, but within the region of influence for LANL. This could include state or local development initiatives; new residential development; new industrial or commercial ventures; clearing land for agriculture; new utility or infrastructure construction and operation; and new waste treatment and disposal activities.

The City of Santa Fe; Los Alamos, Mora, Rio Arriba, Sandoval, San Miguel, Santa Fe, and Taos Counties; the Santa Clara and San Ildefonso Pueblos; the New Mexico Department of Transportation; the U.S. Bureau of Land Management (BLM) and the U.S. Forest Service were contacted for information regarding anticipated future activities that could contribute to cumulative impacts. The City of Santa Fe, and Mora, Sandoval and San Miguel Counties did not identify any major future actions (Gallegos 2006, Pino 2006, Scales 2006, Tafoya 2006). Rio Arriba and Santa Fe Counties, and the Santa Clara and San Ildefonso Pueblos did not provide information for the cumulative impacts analysis. Activities in the region surrounding LANL that were identified include:

- Los Alamos County identified residential, commercial and industrial development on areas transferred from DOE to the County. Residential development includes about 120 homes on 70 acres (28 hectares) in White Rock, with a goal to build approximately 1,000 new homes in Los Alamos County in the next 5 years (Jeppson 2006), and

- Taos County identified about 20 subdivisions scheduled for review this year. This would include 150 to 750 new homes on 300 to 1,500 acres (121 to 607 hectares) (Trujillo 2006). Many of these would be located more than 50 miles (80 kilometers) from LANL.

In addition Los Alamos County is considering closure of the Los Alamos County Landfill, replacement of the Bayo Wastewater Treatment Facility, and utilization of the San Juan Chama water allotment. The existing Los Alamos County Landfill will close in 2007. Solid wastes will be shipped out of the County via a new transfer station (LAC 2005c). The Bayo Wastewater Treatment Facility in Santa Fe County would be replaced with an advanced wastewater treatment facility in Pueblo Canyon. Construction is expected to begin in 2006 (LAC 2004a). The San

Juan Chama Project includes examining the feasibility of pumping 1,200 acre-feet of Rio Grande water up the mesa to Los Alamos (LAC 2004b).

A number of projects were identified that would affect the Santa Fe National Forest. These include: invasive plant control; road closure; thinning and prescribed fire; fire salvage; mineral extraction; and grazing allotment projects (USFS 2005a).

The BLM identified continued road maintenance, timber harvesting, and grazing permit renewals. A number of other projects were identified that would affect BLM lands. These include: the Power Project; New Mexico Products Pipeline; Mid-America Pipeline Western Expansion Project; Santa Domingo Pueblo-BLM land exchange; San Pedro Rock Quarry; treatment of saltcedar and other noxious weeds; and the Buckman Water Diversion Project (BLM 2006a).

- The Power Project involves upgrade and enhancement of the electrical power transmission line system in the Santa Fe and Las Vegas, New Mexico area and widening the existing right-of-way (BLM 2004b);

- The New Mexico Products Pipeline involves supplementing an existing petroleum products pipeline by adding two additional segments. Neither of the new segments would be within 50 miles (80 kilometers) of LANL (BLM 2006b);

- The Mid-America Pipeline Western Expansion Project would add 12 separate loop sections to the existing liquefied natural gas pipeline to increase system capacity. A 23 mile (37 kilometer) segment would be in Sandoval County 30 miles (48 kilometers) from the LANL boundary (BLM 2006c). This segment would be constructed parallel to, and 25 feet (7.6 meters) away from the existing pipeline right-of-way;

- The Santa Domingo Pueblo-BLM land exchange would involve an equal-value exchange of approximately 7,376 acres (2,985 hectares) of BLM lands for 645 acres (261 hectares) of Santa Domingo Pueblo land in Santa Fe and Taos Counties (BLM 2002). A record of decision has not been issued for this land exchange;

- The San Pedro Mountains Rock Quarry has been delayed and will be incorporated into the revised Taos Field Office Resource Management Plan (BLM 2006a);

- The treatment of saltcedar and other noxious weeds is an ongoing adaptive management program for control of exotic weeds. An EA was prepared for this project that resulted in a Finding of No Significant Impact (FONSI) (BLM undated). The project area is approximately 40 miles (64 kilometers) from the LANL boundary; and

- The Buckman Water Diversion Project would divert water from the Rio Grande for use by the City of Santa Fe and Santa Fe County (BLM 2006a). The diversion project would withdraw water from the Rio Grande approximately 3 miles downstream from where Route 4 crosses the river. The pipelines for this project would largely follow existing roads and utility corridors. Decreased water withdrawals from the Buckman Well Field would have beneficial effects on groundwater levels. Potential effects on fish and aquatic

habitats below the proposed project due to effects on water flow would be minimal (BLM and USFS 2004a).

Another project would upgrade the existing 46 kilovolt transmission loop system the serves central Santa Fe with a 115 kilovolt system (PNM 2005). No major new transmission lines are planned for the region around LANL (WAPA 2006).

No new Federal highways are planned within 50 miles (80 kilometers) of LANL (CFLHD 2005). A number of state transportation projects are ongoing or planned. Many of these are relatively minor maintenance, upgrade, widening, and resurfacing projects. Some of the more substantial transportation projects in the region include:

- Interstate 40 reconstruction (2004 to 2008) (NMDOT 2006b);
- U.S. Route 84 reconstruction - Pojoaque to Espanola (2006) (NMDOT 2005a);
- State Route 502 reconstruction from DP Road to the Santa Fe County Line (2006) (NMDOT 2005a);
- State Route 344 four-lane road construction near Interstate 40 (2006 to 2011) (NMDOT 2005a);
- State Route 68 reconstruction and four-lane road construction in Taos County (2006 to 2011) (NMDOT 2005a);
- State Route 14 (Turquoise Trail) reconstruction (2007) (NMDOT 2006b);
- U.S. Route 84 reconstruction in Rio Arriba County (2007 to 2009) (NMDOT 2005a);
- State Route 68 reconstruction north of Espanola (2007 to 2010) (NMDOT 2005a);
- State Route 30 four-lane road construction from NM 502 to Espanola (2008) (NMDOT 2005a);
- State Route 41 reconstruction from Galesteo south to Clark Hill (2008) (NMDOT 2005a); and
- U.S. Route 285 reconstruction and resurfacing north of Ojo Caliente (2008) (NMDOT 2005a).

Although the transportation infrastructure in the region would continued to be maintained, and a number of upgrade, expansion, and widening projects are scheduled over the next 5 years or so, no new major highway projects are scheduled that could substantially contribute to cumulative impacts at LANL.

The list of EPA National Priorities List sites (also known as Superfund sites) was reviewed to determine if these sites could contribute to cumulative impacts at LANL. Only one site is within 50 miles (80 kilometers) of LANL. The North Railroad Avenue groundwater contamination

plume is located over 12 miles (19 kilometers) from the LANL boundary in Rio Arriba County and therefore, would not contribute to cumulative impacts at LANL (EPA 2005c).

Because of the distance from LANL; the routine nature and relatively small size of most of the other actions considered; and the zoning, permitting, environmental review, and construction requirements that these actions must meet, they are not expected to interact with impacts from LANL activities to produce cumulative impacts. In addition, available documentation was reviewed for cumulative impacts, including the following sources:

U.S. Bureau of Land Management

- Draft Environmental Impact Statement for the Buckman Water Diversion Project (BLM and USFS 2004a)
- Factsheet: San Juan Public Lands (San Juan Field Center & San Juan National Forest) Draft Environmental Impact Statement (EIS) Northern San Juan Basin Coalbed Methane Project (BLM 2004a)
- Farmington Proposed Resource Management Plan and Final Environmental Impact Statement, BLM-NM-PL-03-014-1610 (BLM 2003b)
- Farmington Resource Management Plan with Record of Decision (BLM 2003c)
- Final Air Dispersion Analysis Technical Report, Revision to the BLM Farmington Resource Management Plan and Amendment of the Rio Puerco Resource Management Plan (BLM 2003a)

U.S. Forest Service

- Schedule of Proposed Action 01/01/2006 to 03/31/2006, Santa Fe National Forest (USFS 2006)
- Record of Decision for Invasive Plant Control Project Carson and Santa Fe National Forests in Colfax, Los Alamos, Mora, Rio Arriba, San Miguel, Santa Fe, Sandoval, and Taos Counties, New Mexico (USFS 2005b)

U.S. Bureau of Reclamation

- Upper Rio Grande Basin Water Operations Review (Review) and Draft Environmental Impact Statement (DEIS) (U. S. Army Corps, Reclamation, and ISC 2006)
- Final Environmental Impact Statement City of Albuquerque Drinking Water Project (Reclamation 2004)

National Park Service

- Fire Management Plan for Bandelier National Monument (NPS 2005b)

State of New Mexico

- 2004-2006 State of New Mexico Integrated Clean Water Act §303(d) §305(b) Report (NMED 2004a)

- State of New Mexico Standards for Interstate and Intrastate Streams (NMWQCC 2002c)

Each resource area in this SWEIS was reviewed for potential cumulative impacts and the analyses are summarized in the following paragraphs. The level of detail provided for each resource area is dependent on the extent of the potential cumulative impacts. Some resources were not provided with a detailed analysis based on minimal or very localized impacts from LANL operations and a judgment that cumulatively there would be no appreciable impacts to these resources.

Land Resources

Land resources include impacts to land use and the visual environment. For land use, LANL actions proposed under this SWEIS would not likely result in any incompatible land uses. Under the Land Conveyance and Transfer EIS, land transferred by LANL to Los Alamos County and the San Ildefonso Pueblo, could be developed. Up to 826 acres (334 hectares) of this land could be developed after the transfer, with the potential introduction of incompatible land uses and the loss of recreational opportunities. Under the Expanded Operations Alternative, the cumulative impacts would include fewer restrictions on future land use on lands remaining part of the site under the MDA Removal Option (as opposed to the MDA Capping Option) because the wastes currently buried in the MDAs would be removed completely and shipped offsite or consolidated in onsite disposal areas allowing some of these MDAs to be used for other purposes. The Expanded Operations Alternative would also include the Security-Driven Transportation Modification Project which would not conflict with the current land use designations with the exception of an option for a bridge over Sandia Canyon. Construction of the Sandia Canyon Bridge would represent a departure from current site development plans. Overall cumulative impacts to land use in the region would be small.

Conveyance of the land to Los Alamos County and the San Ildefonso Pueblo under the Land Conveyance and Transfer EIS could also result in cumulative visual impacts such as diminished viewsheds and increases in ambient light from residential, industrial and commercial development on previously undeveloped land. For example, Los Alamos County has indicated there are proposals to develop approximately 1,000 new residences on land adjacent to LANL and develop land for light industry along the Los Alamos Canyon rim across from the airport.

Geology and Soils

Proposed actions under the Expanded Operations Alternative would impact mineral resources at LANL and the surrounding region. The primary impacts are due to proposed closures of the MDAs under the Consent Order through either waste containment in place (MDA Capping Option), or waste removal by excavation and offsite disposal (MDA Removal Option).

If the waste at the MDAs is confined in place, the final covers would require 750,000 to 2,000,000 cubic yards (570,000 to 1,500,000 cubic meters) of crushed tuff through FY 2016. Up

to 460,000 cubic yards (350,000 cubic meters) of additional rock, gravel, topsoil, and other bulk materials would be required for the final surface and erosion control. If the waste was removed, approximately 1,300,000 cubic yards (1,000,000 cubic meters) of backfill would be needed to replace the excavated waste and contaminated soil, as well as 61,000 cubic yards (47,000 cubic meters) of rock, gravel, topsoil, and other bulk materials for erosion control and site restoration.

For economic and feasibility reasons, these materials would need to be excavated from borrow pits and quarries in the LANL area (Stephens and Associates 2005). Obtaining the materials locally would minimize transportation impacts. The only borrow pit now in use at LANL is the East Jemez Road Borrow Pit in TA-61. There would be sufficient tuff available at the pit to provide the needed volumes of crushed tuff. However, other sources would be required to provide the other materials (such as soil and coarse material for erosion control) needed to complete the MDA remediation. In 2001, there were 24 stone and aggregate mines or quarries in the surrounding counties (Rio Arriba, Sandoval, and Santa Fe Counties) producing sand, gravel, base course, caliche, crushed rock, rip-rap, scoria, fill dirt and top soil (Pfeil et al. 2001). Borrow materials could also be collected from onsite areas of opportunity, such as facility construction or DD&D areas when excess uncontaminated soils are excavated that meet backfill or capping criteria. The use of excavated soils as fill or cap material would minimize the need for importation of geologic materials from outside the immediate LANL area.

Water Resources

Activities at LANL, in combination with other activities in the vicinity, have the potential to affect regional water resources. For purposes of cumulative effects on surface water, current and reasonably foreseeable future activities within the watersheds and streams that receive surface water from LANL were considered. The effects of past projects are reflected in the description of the affected environment and current surface water conditions. Most of those watersheds have headwaters on Santa Fe National Forest or Bandelier National Monument land. The region for consideration of cumulative impacts on groundwater extends further east towards Santa Fe and focuses on impacts on the regional aquifer from the activities of landowners and managers other than LANL.

Past effluent discharges from LANL activities, in some cases at least 50 years ago, have caused contamination of sediments in several canyons and continue to affect the quality of storm water runoff and stream flows (LANL 2005j). However, as described under Section 4.3.1 of this SWEIS, current monitoring documents that water quality does not exceed state standards downstream from LANL and the existing contamination is expected to diminish over time regardless of the SWEIS alternative selected. The reach of the Rio Grande between San Ildefonso Pueblo and Cochiti Reservoir, which receives surface water flows from LANL, has been identified by NMED (NMED 2004a) as impaired because it does not support its designated uses as a cold water or warm water fishery. Turbidity is identified as the probable cause of impairment but the source of impairment is from unknown natural sources. While turbidity could be exacerbated by earthmoving activities anywhere in the watershed, planned mitigation measures for federal and state projects would keep soil erosion to a minimum ensuring that additional turbidity is not a reasonably foreseeable cumulative impact.

Fire and Vegetation Management

Fire and fuels management is an annual activity within the Santa Fe National Forest and Bandelier National Monument. Management of the areas within the watersheds upstream from LANL are of primary interest because the activities, such as prescribed burns, mechanical and manual thinning, native plant revegetation, and establishment of fire breaks, have the potential to accelerate erosion and sediment delivery to streams, affecting surface water quality and quantity.

Since 1981, areas within Bandelier National Monument along the southern LANL boundary have been treated with prescribed burns. An area parallel to the southern LANL boundary was thinned from 2002 to 2004 (NPS 2005b). The Fire Management Plan (NPS 2005b), the working document for guiding wildland fire management actions and activities in Bandelier National Monument, identifies two primary fire management areas. Most of the area near LANL falls within the Wildland Fire Use unit, in which most natural ignitions will be allowed to burn. A small area including the entire Upper Frijoles watershed near the southern LANL boundary and the detached Tsankawi unit located east of State Highway 4 and near San Ildefonso Pueblo, fall within the Fire Suppression unit. In the Fire Suppression unit, all natural ignitions are declared unwanted wildland fires and are suppressed, but prescribed burns will be utilized as needed.

The Santa Fe National Forest Schedule of Planned Operations does not list specific fire management or other actions in the watersheds that cross LANL over the next year (USFS 2006), but some actions are likely to occur within the next five to ten years. The Santa Fe National Forest and Bandelier National Monument fire management policies and procedures include requirements for mitigation and stabilization measures to ensure that vegetation is reestablished and offsite erosion and sedimentation are minimized. For this reason, fire management activities in the region, in combination with those planned at LANL, are not anticipated to adversely affect surface water quality or quantity. These actions may be beneficial to the surface water bodies by reducing the potential for the impacts of severe wildfires like the Cerro Grande Fire.

An estimated 300 to 800 acres (121 to 324 hectares) will be treated annually on the Santa Fe National Forest for invasive weeds (USFS 2005b). Treatments will combine biological, chemical, and mechanical methods. Some of the areas to be treated are likely to be within watersheds that cross LANL, but mitigation measures will be implemented to ensure that there are no adverse effects to water resources. These activities, in combination with those planned for LANL, would not affect surface water resources.

Cerro Grande Fire Structures

Structures installed after Cerro Grande Fire in and around LANL altered surface water flows to retain sediment. The Northern Rio Grande Resource Conservation and Development Council lead an effort to rebuild fences, bridges, culverts, and other structures that were destroyed by the Cerro Grande Fire on private land (NRCS 2004). On Santa Clara and San Ildefonso Pueblos, fifteen flood prevention projects were implemented by the U.S. Army Corps of Engineers, including strengthening an existing levee system, installing grade control structures, upgrading water crossings, and installing protection around facilities (U.S. Army Corps 2000). Most private structures are likely to remain in place, but removal of some structures is planned by the U.S. Army Corps of Engineers, in addition to those at LANL and their removal would have the

potential to increase sediment loads temporarily. Where structures are removed, the responsible agencies will likely install temporary sediment traps to minimize downstream sediment transport that would adversely affect surface water quality.

Land Conveyance and Transfer

The Land Conveyance and Transfer EIS for conveyance and transfer of lands from LANL to either the County of Los Alamos or San Ildefonso Pueblo projected minor increases in the amount of surface water runoff entering the stream system and an approximate 30 percent increase in groundwater withdrawals from the regional aquifer due to new residential development (DOE 1999d).

Rio Grande Flows

Proposed changes in the operations of Abiquiu Dam, Cochiti Dam, and other water structures downstream are currently under consideration by the U.S. Army Corps of Engineers, Bureau of Reclamation, and New Mexico Interstate Stream Commission (U.S. Army Corps, Reclamation, ISC 2006). These changes would slightly affect stream flows in the Rio Chama and Rio Grande, depending on which alternative is selected for implementation, but none of the alternatives would affect the surface water flows of the tributaries that flow through and immediately downstream of LANL. Changes to flows below Abiquiu Dam are not projected to affect hydropower generation used to supplement electricity in Los Alamos County (U.S. Army Corps, Reclamation, ISC 2006).

The City of Albuquerque is currently constructing a dam across the Rio Grande at Albuquerque to divert as much as 94,000 acre-feet per year (11,600 hectare-meters per year) to fully consume their San Juan-Chama Project water. A final EIS evaluating impacts was published on March 5, 2004 (Reclamation 2004) and the ROD was issued on June 1, 2004. Direct effects on hydrology from any of the action alternatives were projected to include a constant increase of about 60 to 70 cubic feet per second (1.7 to 2.0 cubic meters per second) from flows of the City's San-Juan Chama Project water between Abiquiu Reservoir and Albuquerque at any time the diversion system is operating (Reclamation 2004). Contamination from canyons flowing through LANL that outlet into the Rio Grande and any potential changes in Rio Grande flows from proposed changes at LANL under any alternative are not likely to affect Albuquerque's water quality or quantity because any contaminated sediments would be trapped behind the dam and flows would be regulated by water operations at Cochiti Dam.

The City of Santa Fe is proposing to install a diversion dam on the east bank of the Rio Grande across from San Ildefonso Pueblo and upstream from White Rock. The purpose of this project is to seek "sustainable means of accessing surface water supplies that would use the applicants' water rights by diverting San Juan-Chama Project water and native Rio Grande water while reducing their reliance on over-taxed ground water resources" (BLM and USFS 2004b). The Buckman Well Field currently consists of thirteen wells that draw from the regional aquifer, but well yields have been reduced and groundwater levels declined since its inception, causing depletions of nearby streamflows (BLM and USFS 2004b). The diversion, which will divert up to 5,230 acre-feet per year from the river (BLM and USFS 2004b), is planned to be located in the

Rio Grande near the area where Mortandad Canyon outlets on the west side of the river and downstream from the outlets of Pueblo, Sandia, and Los Alamos Canyons.

Santa Fe proposes to continue providing residual offsets from past pumping of the Buckman Well Field (currently about 2,500 acre-feet per year). Under the proposed action, it is projected that pumping from the Buckman Well Field would be scaled back to a long-term average of approximately 1,000 acre-feet per year. The cone of depression in the regional aquifer from current pumping of the well field has been modeled to extend to the west side of the Rio Grande, encompassing White Rock and the eastern part of LANL (BLM and USFS 2004b). The DEIS for the Buckman Well Field Project predicts that direct diversions with reduced pumping from the Buckman Well Field, if the proposed action were implemented, would result in a 1 percent reduction in Rio Grande flows below the diversion and a significantly smaller cone of depression after the diversion project is established (by 2007) because pumping and aquifer depletions would be greatly reduced (BLM and USFS 2004b). The projected reductions of aquifer depletions from reduced pumping of the Buckman Well Field would help offset projected increases in water use by LANL and Los Alamos County.

Under the RLWTF Zero Discharge Option included in the Expanded Operations Alternative, reduction of contaminant contributions from elimination of the outfall from the RLWTF into Mortandad Canyon and improved water quality monitoring would provide beneficial impacts on surface water quality that may benefit Santa Fe's project.

The City of Los Alamos and San Ildefonso Pueblo are considering diverting Rio Grande water, and there may be other projects similar to the Buckman Project that would divert San Juan-Chama and native waters from the Rio Grande in the vicinity of LANL. San Ildefonso Pueblo installed a single unit infiltration collector well as a pilot project in 2001. These projects may contribute to cumulative effects on the regional surface water system but are less well defined, so the effects are impossible to predict at this time (BLM and USFS 2004b).

Groundwater Quality

Additional modeling and monitoring wells are needed to determine the foreseeable future impacts on the regional aquifer from radionuclides and other contaminants derived from former LANL waste disposal that are thought to be migrating through the bedrock. Questions about the rate and direction of contaminant movement must be more thoroughly investigated before the cumulative effects on water resources can be evaluated. LANL will be conducting future data collection activities, along with analysis of existing data, to better define the interaction between groundwater and the rock matrix. This understanding of the hydrologic and chemical components at the site will aid in the development of sound conceptual models of flow and transport through the fractures and matrix of the vadose zone into the saturated zone. The new data, coupled with improvement in numerical flow and transport models and improved calculational techniques, will enable better prediction of flow and transport of groundwater in the LANL region and more accurately define the ultimate impacts on the regional groundwater resources below LANL. Recent news of chromium in the regional aquifer (Snodgrass 2006) will also require additional research to determine the source of the contaminant.

Air Quality and Noise

Table 5–76 presents the estimated maximum cumulative air quality concentrations offsite or at the site boundary from operations if the LANL SWEIS Expanded Operations Alternative were adopted and a new modern pit facility were operating at its highest projected level of production. The cumulative concentrations of the all criteria pollutants are expected to remain in compliance with Federal and state ambient air quality standards. Cumulative air quality impacts for the No Action and Reduced Operations Alternatives would be lower still.

Effects on air quality from construction, excavation, and remediation activities could result in temporary increases in air pollutant concentrations at the site boundary and along roads to which the public has access. These impacts would be similar to the impacts that would occur during the construction of a housing project or a commercial complex. Emissions of fugitive dust from these activities would be controlled with water sprays and other engineering and management practices as appropriate. The maximum ground-level concentrations offsite and along roads to which the public has regular access would be below the ambient air quality standards, except for possible short term concentrations of nitrogen oxides and carbon monoxide for certain projects that occur near the site boundary. The impact on the public would likely be minor.

Table 5–76 Estimated Maximum Cumulative Air Quality Concentrations at the Site Boundary (micrograms per cubic meter)

Criteria Pollutant	*Averaging Period*	*LANL SWEIS (Expanded Operations)* [a]	*MPF EIS (450 Pits Per Year Alternative)* [b]	*Cumulative Concentration*	*Most Stringent Standard or Guideline* [a]
Carbon monoxide	8 Hours 1 Hour	192.4 1,071	12 17	204.4 1,088	7,900 11,900
Nitrogen dioxide	Annual 24 Hours	7.0 40.2	5.7 28.7	12.7 68.9	75 150
Sulfur dioxide	Annual 24 Hours 3 Hours	10.2 83.5 397.3	0.42 2.1 4.8	10.6 85.6 402.1	42 209 1,050
Total suspended particulates	Annual 24 Hours	5.7 135.0	0.46 2.3	6.2 137.3	60 150
PM_{10}	Annual 24 Hours	5.24 101.6	0.17 0.84	5.4 102.4	50 150

MPF = modern pit facility, PM_{10} = particulate matter less than or equal to 10 microns in diameter.

[a] Data from Table 5–8 of this LANL SWEIS. Criteria pollutants released from LANL operations are emitted primarily from combustion sources such as boilers and emergency generators. Although motor vehicle emissions have an impact on local air quality, no quantitative analysis of vehicle emissions was performed as part of the LANL SWEIS. The contribution of vehicle emissions were assumed to be included in the background monitoring concentrations discussed in the current and 1999 SWEIS. The results of the modeling demonstrate that the simultaneous operation of LANL's air emission sources at maximum capacity as described in the Title V permit application would not exceed any state or federal ambient air quality standards. All of the equipment at the TA 3 Co-Generation Complex, including an additional Combustion Turbine Generator that would be constructed in the 2007 to 2013 time frame would all operate within the emission limits specified in the air quality permit.

[b] Data from Table 5.2.3.1–3 of the MPF EIS (DOE 2003b).

The impacts of toxic air pollutants were assessed based on the analysis in the *1999 SWEIS* and the emission estimates in the LANL Yearbooks. In all but two cases, the estimated toxic pollutant emissions were below the corresponding guideline values established for the screening

analysis in the *1999 SWEIS*. Guideline values are the levels established to screen emission rates for further analysis. The two cases where estimated emission rates were above guideline values and were referred to the human health and ecological risk assessment processes were: 1) emissions from High Explosives Firing Site operations at TA-14, TA-15, TA-36, TA-39, and TA-40; and 2) the additive emissions from all of the pollutants from all technical areas on receptor sites located near the Los Alamos Medical Center. The risk assessment analysis demonstrated that the pollutants released for these two cases would not be expected to cause air quality impacts that would affect human health and the environment.

Cumulative air quality impacts from offsite construction and operation activities were also evaluated. The maximum impacts from construction activities (including fugitive dust) for oil and gas development in the region were shown to occur very close to the source, with concentrations decreasing rapidly with distance (BLM 2003b). Therefore, it is expected that offsite air emissions from disturbance and construction would not contribute substantially to cumulative impacts at LANL.

Impacts of inert pollutants (pollutants other than ozone and its precursors) are generally limited to a few miles downwind from a source (BLM 2003b). For emissions from the well fields analyzed in the *Farmington Proposed Resource Management Plan and Final EIS* (BLM 2003b), the distance where the nitrogen dioxide concentrations drop below their significance levels would be 15.6 to 24.9 miles (25 to 40 kilometers). Therefore, it is expected that emissions from the operation of offsite facilities would not contribute substantially to cumulative impacts at LANL which is about 100 miles (160 kilometers) away.

In contrast, the maximum effects of volatile organic compounds and nitrogen oxides emissions on ozone levels usually occurs several hours after they are emitted and many miles from the sources (BLM 2003b). Although LANL is outside the study areas for the Northern San Juan Basin Coalbed Methane Project, the EIS for this project (BLM 2004a) determined that cumulative impacts of oil and gas development when combined with regional emissions from other sources could exceed visibility thresholds (9 to 25 days annually) in the Class I Areas of the Weminuche Wilderness and Mesa Verde National Park. They also found that these impacts could be reduced to 1 to 17 days annually if stricter emissions controls are required for new emission sources of nitrogen oxide (BLM 2004a). LANL is approximately 100 miles (161 kilometers) from the Bloomfield Farmington area and the San Juan Basin Coalbed Methane Project area, and it is unclear if these distant emissions could contribute to cumulative visibility impacts at the Bandelier National Monument.

The air quality analysis in the Farmington Proposed Resource Management Plan and Final EIS (BLM 2003b) included consideration of air emissions from the highly industrialized Bloomfield gas corridor, El Paso Blanco compressor station, Conoco San Juan Gas Plant, and Four Corners and San Juan Power Plants (BLM 2003a). Although LANL is outside the study areas for the Farmington Proposed Resource Management Plan and Final EIS (BLM 2003b), the Record of Decision for this study (BLM 2003c) included a number of mitigation measures designed to reduce the cumulative air quality impacts from gas and oil wells and pipelines. One of the more significant mitigation measures requires that new and replacement wellhead compressors limit their nitrogen oxide emissions to less than 10 grams per horsepower-hour, and each pipeline compressor station shall limit its total nitrogen oxide emissions to less than 1.5 grams per

horsepower-hour. This requirement would apply to all new and replacement compressor engines, unless the proponent can demonstrate (using air pollutant dispersion modeling) that a specific higher emission rate would not cause or contribute to an exceedance of any ambient air quality standard. This measure is intended to substantially reduce the level and extent of emissions that form ozone throughout the region and reduce visibility impacts on Class I Areas such as Mesa Verde National Park and Bandelier National Monument (BLM 2003b).

The incremental increase in criteria and toxic pollutant emissions identified in the *Final Environmental Impact Statement for the Conveyance and Transfer of Certain Land Tracts Administered by the U.S. Department of Energy and Located at the Los Alamos National Laboratory, Los Alamos and Santa Fe Counties, New Mexico*, DOE/EIS-0293 (DOE 1999d) would not be major and would not cause or contribute to an exceedance of any ambient air quality standard.

Ecological Resources

The continuing transfer of LANL land under the Land Conveyance and Transfer EIS to the County of Los Alamos and the Department of the Interior to be held in trust for San Ildefonso Pueblo would result in the cumulative impact of the conveyance of 770 acres (312 hectares) of undeveloped habitat which could potentially be developed. A transfer of resource protection responsibility may also result in a less rigorous environmental protection review process. Power grid upgrades would have minimal effects of vegetation and temporary impacts on wildlife. The Wildlife Hazard Reduction Program would have short-term impacts on wildlife, create historic forest conditions and have a positive effect on the Mexican spotted owl due to healthier habitat. The disposition of flood retention structures would have short-term impacts on wildlife and its habitat and potential temporary impacts on downstream wetlands as a result of possible habitat disturbance and changes in the water flow rate. The Trails Management Program would have short-term impacts on wildlife and an increase in diversity of wildlife where trails are closed. Section 5.5 of this SWEIS has a detailed discussion of the effects of each alternative on ecological resources.

Human Health

Table 5–77 presents the estimated cumulative impacts from radiological emissions at LANL. Cumulative impacts to the public would likely remain within the maximum level of impacts forecasted under the SWEIS Expanded Operations Alternative. No cancer deaths (LCFs) would be expected in terms of the MEI or in the general population. The dose to the maximally exposed offsite individual would be expected to remain within the 10 millirem per year limit required by the Clean Air Act. There would be no increase expected in the number of LCFs among the general public even if a modern pit facility operations were located at LANL.

Collective worker doses would increase substantially if a facility producing 450 pits annually were located at LANL at the same time that the Expanded Operations Alternative MDA Removal Option was being implemented. Collective worker dose would increase from less than 200 person-rem per year to an annual average of 1,080 person-rem per year. Worker dose would decrease by about 110 person-rem annually after the MDA remediation work was complete. Individual worker dose would be maintained ALARA and within applicable regulatory limits.

Table 5–77 Estimated Cumulative Impacts from Radiological Emissions

Activity	General Public				Worker Population	
	Maximally Exposed Individual		Population Within 50 Miles			
	Dose (millirem per year)	Latent Cancer Fatality Risk per year	Collective Dose (person-rem per year)	Excess Latent Cancer Fatalities per year	Collective Dose (person-rem per year)	Excess latent cancer fatalities per year
LANL SWEIS Alternatives						
No Action	7.8	4.7×10^{-6}	30	0.018	281	0.17
Reduced Operations	0.79	4.7×10^{-7}	6.4	0.0038	258	0.15
Expanded Operations	8.2	4.9×10^{-6}	36	0.022	520	0.31
Other Actions						
Modern Pit Facility [a]	1.2×10^{-7}	7×10^{-14}	1.0×10^{-6}	6×10^{-10}	560	0.34
Total	0.79 to 8.2	4.7×10^{-7} to 4.9×10^{-6}	6.4 to 36	0.0038 to 0.022	818 to 1,080	0.71
Dose Limit [b]	10	NA	NA	NA	NA	NA

NA = not applicable.
[a] *MPF EIS* (DOE 2003b) Tables 5.2.9.1-1 and 5.2.9.1-2; 450 pits per year alternative.
[b] 10 millirem per year limits as required by the Clean Air Act.

Cultural Resources

Actions proposed under the Land Conveyance and Transfer EIS would result in the cumulative impact of the conveyance and transfer of cultural resources out of the responsibility and protection of the DOE. A consequence of this transfer and conveyance would be potential damage to cultural resources on land due to future development and impacts to the protection and accessibility to American Indian sacred sites.

Infrastructure

Table 5–78 presents the estimated cumulative infrastructure requirements at LANL for electricity, natural gas and water. Cumulative infrastructure requirements include usage projections through 2011 for LANL and other Los Alamos County users that rely upon the same utility system. Therefore, the projections provided in Section 5.8.2 and adopted here, already include consideration of the cumulative future usage of these utilities by DOE and non-DOE entities. Projections of future utility use in Los Alamos County are largely related to increased usage due to population growth, and associated industrial and commercial development.

As shown in Table 5–78, if a new modern pit facility were located at LANL, the combined electrical demand (peak load site capacity) and water use could exceed current capacity when combined with the Expanded Operations Alternative under this SWEIS. While it is projected that the electric peak load capacity would be exceeded, the projection does not take into account completion of a new transmission line and other power grid upgrades which would help offset the deficit in peak load capacity and would ensure that electrical energy availability would not be problematic for operations. Also, LANL has provisions to install a second new turbine at the TA-3 Co-Generation Complex that would add an additional 20 megawatts (175,200 megawatt-hours) of generating capacity beyond 2006.

Table 5–78 Estimated Cumulative Infrastructure Requirements for the LANL Region of Influence

Activity	*Electricity*		*Natural Gas (decatherms per year)*	*Water (millions of gallons per year)*
	(megawatt-hours per year)	*Peak load (megawatts)*		
LANL SWEIS Alternatives Projected through 2011 [a]				
No Action	632,000	112	2,213,000	1,682
Reduced Operations	497,000	84.5	2,190,000	1,605
Expanded Operations	814,000	145	2,320,000	1,816
Other Actions				
Modern Pit Facility [b]	178,814	36.5	272,977	133
Total (range)	675,814 to 992,814	121 to **181.5**	2,462,977 to 2,592,977	1,738 to **1,949**
System Capacity [c]	1,314,000	150	8,070,000	1,806

[a] Data from Table 5–34, 5–35, and 5–36. Projections through 2011 for electrical energy, peak load, natural gas, and water also include projected usage for other Los Alamos County users that rely upon the same utility system.
[b] *CMRR EIS* (DOE 2003f) Table 4-27, and *MPF EIS* (DOE 2003b) Table 5.2.2.2-2; 450 pits per year alternative.
[c] Data from Table 5–33. Electrical energy and peak load capacity reflect the current import capacity of the electric transmission lines that deliver electric power to the Los Alamos Power Pool and completion of upgrades at the TA-3 Co-Generation Complex adding 40 megawatts (350,400 megawatt-hours) of generating capacity.
Note: Potential exceedances of system capacity are shown in **bold**. A decatherm is equivalent to 1,000 cubic feet.

For water use, Los Alamos County, as owner and operator of the Los Alamos Water Supply System, is currently pursuing the use of San Juan-Chama Transmountain Diversion Project water to secure additional water rights and supply for its water customers that include LANL. This would supply the Los Alamos area with up to an additional 391 million gallons (1,500 million liters) of water per year. Without the San Juan-Chama water, demand could exceed the available water supply in the future.

In the near term no infrastructure capacity constraints are anticipated. LANL operational demands to date on key infrastructure resources, including electricity and water, have been below projected levels and within site capacities. Any potential shortfalls in available capacity would be addressed as increased site requirements are more fully understood.

Waste Management

Table 5–79 presents the estimated amount of radioactive and chemical waste that would be generated for the LANL SWEIS Alternatives (through 2016) when combined with potential waste from a new modern pit facility. Cumulative waste generation rates for all waste types are expected to be substantial, largely due to future remediation and DD&D of facilities, and the potential operation of a new modern pit facility. Although this is the case under all of the proposed LANL SWEIS alternatives, the quantities of wastes projected under the Expanded Operations Alternative are significantly greater than those projected under the other alternatives due to the extensive environmental restoration cleanup projects associated with the MDAs and DD&D activities.

Table 5–79 Estimated Cumulative Waste Generation at LANL (2007 to 2016)

Activity	Transuranic (cubic yards)	Low-Level Radioactive (cubic yards)	Mixed Low-Level Radioactive (cubic yards)	Construction and Demolition Waste (cubic yards)	Chemical (pounds)
LANL SWEIS Alternatives (2007-2016) [a]					
No Action	3,500 to 5,900	71,000 to 156,000	1,800 to 2,700	197,000	19,000,000 to 37,000,000
Reduced Operations	3,500 to 5,900	71,000 to 137,000	1,800 to 2,700	197,000	19,000,000 to 37,000,000
Expanded Operations	5,400 to 33,000	275,000 to 1,403,000	4,000 to 183,000	656,000 to 736,000	65,000,000 to 129,000,000
Reasonably Foreseeable Future Actions					
Modern Pit Facility [b]	15,000	66,000	55	105,000	81,000
Total (range) [c]	18,000 to 48,000	137,000 to 1,469,000	1,900 to 183,000	302,000 to 841,000	19,000,000 to 129,000,000

[a] Data rounded from Table 5–37.
[b] *MPF EIS* (DOE 2003b) Table 5.2.13.2-1 and 5.2.13.2-2; 450 pits per year alternative operating for 10-years; hazardous waste converted assuming 1,000 pounds per cubic yard.
[c] Total is a range that includes the minimum and maximum values from the LANL SWEIS alternatives. Total may not equal the sum of the contributions due to rounding.

The waste estimates included in the Expanded Operations Alternative in this SWEIS includes expanding pit production to 50 pits per year under single-shift operations (80 pits per year using multiple shifts) from 20 pits per year under the No Action Alternative. Wastes associated with pit production are also accounted for in the modern pit facility estimates in Table 5–79. Therefore, Table 5–79 overestimates cumulative waste generation associated with pit production.

Increases in the cumulative waste generation rate may require the construction of additional facilities and assignment of additional staff to manage the wastes. All categories of waste are expected to see increased generation rates, including solid, chemical, low-level radioactive, transuranic, and mixed wastes. Substantial quantities of low-level radioactive wastes and solid wastes (primarily uncontaminated debris from excavation, construction and demolition activities) are projected. Efforts will be made to recycle as much of the uncontaminated fill as reasonably possible to reduce the need to bring additional fill from offsite to satisfy LANL's ongoing requirements for such materials. Most wastes, with the exception of some low-level radioactive waste, are disposed offsite at permitted facilities.

Low-level radioactive waste generation rates will increase under all alternatives, but the most significant increase is seen in the Expanded Operations Alternative. A modern pit facility would also generate significant quantities of low-level radioactive waste. The expansion of TA-54 Area G into Zone 4 is expected to provide onsite low-level radioactive waste disposal capacity for operations waste through the 2016 timeframe and beyond. In addition, offsite disposal options for low-level radioactive waste include NNSA's Nevada Test Site and a number of commercial facilities, including facilities in Washington, Utah and South Carolina. For these commercial facilities, some restrictions apply to acceptance of waste based on the origin (state of origin, and DOE or non-DOE generated) and radiological characteristics of the waste. Mixed low-level radioactive waste generation is also expected to increase, but the quantity is projected to be less than two percent of the quantity of low-level radioactive waste. Mixed low-level radioactive

wastes may be sent offsite for treatment of the hazardous component and possibly returned to LANL (or disposed elsewhere) as low-level radioactive waste.[2]

The Record of Decision for the *WIPP SEIS* allows for the disposal of 175,600 cubic meters (229,667 cubic yards) of transuranic waste at WIPP (63 FR 3624), of which 21,000 cubic meters (27,466 cubic yards) of contact-handled transuranic waste and 230 cubic meters (301 cubic yards) of remote-handled transuranic waste were anticipated to originate from LANL (DOE 1997b). Transuranic waste generated under the Expanded Operations Alternative and the total cumulative transuranic generation shown in Table 5–79 could exceed this amount. Transuranic waste would be stored onsite until additional disposal capacity, at WIPP or elsewhere, was identified. The impacts of disposal of transuranic waste at WIPP are evaluated in the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* (DOE 1997b).

Although routine generation of chemical wastes is expected to decline under all alternatives compared to current operations at LANL, significant quantities of this waste type are expected due to environmental restoration activities, and to a lesser extent, DD&D activities. This increase is particularly evident under the Expanded Operations Alternative. Offsite treatment options are available at commercial facilities across the country, including treatment and disposal facilities in Nevada, Colorado, Utah and Texas (U.S. Army Corps 2006).

Significant quantities of non-radioactive solid wastes, including construction and demolition debris, would be generated under all alternatives. The most significant increase would occur under the Expanded Operations Alternative. The planned closure of the Los Alamos County Landfill by the end of 2007 means that in the future solid wastes will be disposed of via the Los Alamos County Transfer Station, where wastes would be segregated and then transported to an appropriately permitted solid waste landfill. Construction and demolition wastes would be recycled and reused to the extent practicable. Debris that cannot be recycled would be disposed at solid waste landfills or construction and demolition debris landfills. Los Alamos County is currently evaluating regional solid waste landfills within 120 miles of LANL for a possible contract for disposal of the LANL and Los Alamos County waste, including the Rio Rancho, Sandoval County, and Torrance County/Bernalillo County Landfills. In 2000, the NMED Solid Waste Bureau estimated that the State had approximately 30 years of landfill capacity remaining. (NMED 2000)

Transportation

The collective dose, cumulative health effects, and traffic fatalities from approximately 100 years of radioactive material and waste transport across the United States are estimated in **Table 5–80**. The total collective worker dose from all types of shipments (general transportation, historical DOE shipments, reasonably foreseeable actions, and the *LANL SWEIS* alternatives) was estimated to be 360,280 to 361,030 person-rem which would result in 216 to 217 LCFs among the affected transportation workers. The total collective dose to the general public was estimated to be 339,900 to 340,130 person-rem which would result in 204 excess LCFs among the affected

[2] *Mixed waste that is successfully treated for a characteristic would no longer be mixed waste. Listed mixed waste is always mixed. No mixed waste is currently disposed onsite at LANL.*

general population. The total estimated traffic fatalities associated with accidents involving radioactive material and waste transports would be 100 to 103. The majority of the collective doses for workers and the general population are associated with the general transportation of radioactive material. Examples of these activities are shipments of radiopharmaceuticals to nuclear medicine laboratories and shipments of commercial low-level waste to commercial disposal facilities. The majority of the traffic fatalities are due to the general transportation of radioactive materials (22 fatalities) and reasonably foreseeable actions (74.5 fatalities).

Table 5–80 Cumulative Impacts of Radioactive Material and Waste Transport (1943 to 2047) [a]

Activity	Worker		General Public		Traffic Fatalities
	Collective Dose (person-rem)	Latent Cancer Fatalities	Collective Dose (person-rem)	Latent Cancer Fatalities	
LANL SWEIS Alternatives [b]					
No Action	147	0.088	49	0.030	0.28
Reduced Operations	131	0.079	44	0.027	0.25
Expanded Operations	up to 884	up to 0.53	up to 271	up to 0.16	up to 2.9
Other Past, Present, and Reasonably Foreseeable Future Actions					
General Transportation (1943 to 2047) [c]	330,000	198	290,000	174	22
Historical DOE Shipments [c]	330	0.20	230	0.14	No data
Reasonably Foreseeable Actions [c]	21,000	12.6	48,000	29	74.5
High Level Waste and Spent Nuclear Fuel Disposal at Yucca Mountain (up to 2047) [c, d]	8,800	5.3	1,600	0.96	3.1
Modern Pit Facility [e]	18	0.011	29	0.017	0.028
Total [f]	360,280 to 361,030	216 to 217	339,900 to 340,130	204	100 to 103

[a] Collective dose, health effects, and traffic fatalities associated with transporting radioactive materials and waste.
[b] From Table 5–51.
[c] From Yucca Mountain EIS (DOE 2002b) and Table K–10 of this LANL SWEIS.
[d] From Yucca Mountain EIS (DOE 2002b), Proposed Action, Mostly rail alternative.
[e] MPF EIS (DOE 2003b) Table 5.2.12.2-2 and 5.2.13.2-3; 450 pits per year alternative operating for 10-years.
[f] Total is a range that includes the minimum and maximum values from the LANL SWEIS alternatives. Total may not equal the sum of the contributions due to rounding.
Note: LCFs calculated using a conversion of 0.0006 LCFs per person-rem.

Table 5–80 shows that the impacts of alternatives evaluated in this *LANL SWEIS* are quite small compared with the overall transportation impacts associated with radioactive materials and waste shipments across the United States. *LANL SWEIS* alternatives are expected to result in no worker or public cancer deaths (LCFs) and no more than 3 traffic fatalities (through 2016), and therefore would not contribute substantially to cumulative impacts. For perspective, in 2004, there were 522 traffic fatalities in New Mexico and 58 in the three neighboring counties (Los Alamos, Rio Arriba, and Santa Fe) (see Table 4–51). Nationwide, in 2004, there were more than 42,000 traffic fatalities (NCSA 2006).

Local Transportation

The potential impacts to traffic at the main access points to LANL are estimated in **Table 5–81**. The modern pit facility, if located at LANL and operating at a 450 pit production level, combined with this SWEIS's No Action Alternative would result in an 14 percent increase in daily traffic in and around LANL. If the Reduced Operations Alternative were chosen for this SWEIS, combined with a modern pit facility, the resulting increase in traffic would be 10 percent versus 14 percent under the No Action Alternative. The largest estimated daily traffic increase would occur if the SWEIS Expanded Operations Alternative – MDA Removal Option were selected and a modern pit facility was constructed at LANL. Under this scenario, daily traffic could increase by up to 30 percent. Approximately 17 percent of the increase would be associated with increased vehicle trips under this SWEIS's Expanded Operations Alternative and 13 percent would be due to operation of the modern pit facility.

Development of land transferred under the Land Conveyance and Transfer EIS could, after the land was remediated, result in an increase in traffic in the vicinity of the airport and TA-21 based on current Los Alamos County plans to develop light industry on these tracts. This action combined with the increased traffic due to DD&D activities at TA-21 could cause excessive traffic loads on NM 502.

Table 5–81 Summary of Changes in Traffic Flow at the Entrances to Los Alamos National Laboratory

Alternative	*Average Daily Vehicle Trips*				
	Diamond Drive Across Los Alamos Canyon	***Pajarito Road at State Road 4***	***East Jemez Road at State Road 4***	***West Jemez Road at State Road 4***	***DP Road at Trinity Drive***
Baseline	24,545	4,984	9,502	2,010	1,255
LANL SWEIS					
Reduced Operations Alternative	-900	-200	-400	-90	-50
Expanded Operations – MDA Removal Option – Increase in Daily Trips	+1,500	+3,800	+1,200	+200	+400
Other Past, Present, and Reasonably Foreseeable Future Actions					
Modern Pit Facility	+3,300	+700	+1,300	+300	+200
Total Change in Daily Vehicle Trips	+2,400 to 4,800	+500 to 4,500	+900 to 2,500	+210 to 500	+150 to 600
Percent Change from Baseline	+10 to 20	+10 to 90	+9 to 26	+10 to 25	+12 to 48

Note: Incremental changes for LANL SWEIS Alternatives may not match earlier tables due to rounding.

East Jemez Road, as designated by the State of New Mexico and governed by 49 CFR 397, is the primary route for the transportation of hazardous and radioactive materials. Therefore, hazardous and radioactive material shipments leave or enter LANL from East Jemez Road to NM 4 to NM 502. All shipments would meet the applicable U.S. Department of Transportation, U.S. Nuclear Regulatory Commission, and DOE requirements.

Summary of Cumulative Impacts

Each resource area in this SWEIS was reviewed for potential cumulative impacts and the analyses are summarized in the following paragraphs. The level of detail provided for each resource area is dependent on the extent of the potential cumulative impacts. Some resources were not provided with a detailed analysis based on minimal or very localized impacts from LANL operations and a judgment that cumulatively there would be no appreciable impacts on these resources.

The following paragraphs summarize cumulative impacts for LANL and the surrounding region of influence. The maximum cumulative impacts for all resource areas would occur if the decisions to implement the Expanded Operations Alternative in this SWEIS and locate a facility producing 450 pits annually at LANL were made.

Land Use, Visual Resources, Ecological Resources, and Cultural Resources

Cumulative impacts on land use, visual resources, ecological resources and cultural resources are largely due to the conveyance and transfer of land to Los Alamos County and the Department of Interior in trust for the San Ildefonso Pueblo as required under Public Law 105-119. Up to 826 acres (334 hectares) of land could be developed after the transfer. For example, Los Alamos County has indicated there are proposals to develop approximately 1,000 new residences on land adjacent to LANL and develop land for light industry along the Los Alamos Canyon rim across from the airport. This could change the current land use and increase cumulative impacts on visual, ecological and cultural resources.

Geology and Soils

For geology and soils, the primary impacts are due to proposed closures of the MDAs under the Expanded Operations Alternative in compliance with the Consent Order. If the waste at the MDAs is confined in place (MDA Capping Option), the final covers would require up to 2,000,000 cubic yards (1,500,000 cubic meters) of crushed tuff through FY 2016. Up to 460,000 cubic yards (350,000 cubic meters) of additional rock, gravel, topsoil, and other bulk materials would be required for the final surface and erosion control. These fill materials would likely be obtained from both LANL resources and the 24 quarries and mines in the surrounding counties. While the quantity of materials would be large, there are sufficient resources in the region to meet the demand.

Water Resources

For water resources, reasonably foreseeable future activities in the region have the potential to affect surface water and groundwater in combination with past and present activities as well as those proposed at LANL in this SWEIS. Mitigation measures implemented by federal agencies during fire and vegetation management projects and modification of water control structures installed after the Cerro Grande Fire would minimize impacts on surface water quality and quantity. Additional groundwater depletion projected as a result of potential new residential development within Los Alamos County may be somewhat offset by reduced depletion of the regional aquifer following implementation of the City of Santa Fe's water diversion project and reduced pumping of the Buckman Well Field. Monitoring of the quality and quantity of the

regional aquifer would be needed to evaluate the rate and direction of contaminant movements, as well to track the amount of water available for use.

Air Quality

The cumulative concentrations of all criteria pollutants are expected to remain in compliance with Federal and state ambient air quality standards.

The effects on air quality from construction, excavation, and remediation activities could result in temporary increases in air pollutant concentrations at the site boundary and along roads to which the public has access. These impacts would be similar to the impacts that would occur during the construction of a housing project or a commercial complex. Emissions of fugitive dust from these activities would be controlled with water sprays and other engineering and management practices as appropriate. The maximum ground-level concentrations offsite and along roads to which the public has regular access would be below the ambient air quality standards, except for possible short term concentrations of nitrogen oxides and carbon monoxide for certain projects that occur near the site boundary. The impact on the public would likely be minor.

The contribution to cumulative air quality impacts from offsite construction and operation activities was also evaluated. The maximum impacts from construction activities (including fugitive dust) for oil and gas development in the region were shown to occur very close to the source, with concentrations decreasing rapidly with distance. Therefore, it is expected that offsite air emissions from disturbance and construction would not contribute substantially to cumulative impacts at LANL.

Impacts of inert pollutants (pollutants other than ozone and its precursors) were found to be generally limited to a few miles downwind from the source. For emissions from the well fields, the distance where the nitrogen dioxide concentrations dropped below their significance levels was 15.6 to 24.9 miles (25 to 40 kilometers). Therefore, it is expected that emissions from the operation of offsite facilities would not contribute substantially to cumulative impacts at LANL.

In contrast, the maximum effects of volatile organic compounds and nitrogen oxides emissions on ozone levels usually occurs several hours after these compounds are emitted and many miles from their sources. A number of mitigation measures for activities occurring in the region are designed to reduce the cumulative air quality impacts from gas and oil wells and pipelines. One of the more successful mitigation measures requires that new and replacement wellhead compressors limit their nitrogen oxide emissions to less than 10 grams per horsepower-hour, and each pipeline compressor station limit its total nitrogen oxide emissions to less than 1.5 grams per horsepower-hour. This measure is intended to substantially reduce the level and extent of emissions that form ozone throughout the region and reduce visibility impacts on Class I Areas such as Bandelier National Monument.

Human Health

For human health, the dose to the general public from all anticipated airborne emissions at LANL (Expanded Operations Alternative with the addition of a modern pit facility) could be as much as 36 person-rem per year. The dose to the maximally exposed offsite individual from all anticipated airborne emissions at LANL (Expanded Operations Alternative with the addition of a

modern pit facility) could be as much as 8.2 millirem per year. The Clean Air Act limits airborne doses to 10 millirem year to any individual member of the public. No additional LCFs would be expected at these dose levels.

Collective worker doses would increase substantially if a facility producing 450 pits per year were located at LANL at the same time as the Expanded Operations Alternative MDA Removal Option was being implemented. Collective worker dose would increase from 281 person-rem per year under the No Action Alternative to an annual average of 1,080 person-rem per year. Worker dose would decrease by about 110 person-rem annually after the MDA remediation work was complete. At a collective dose of 1,080 person-rem per year, less than one (0.71) LCF would be expected. Individual worker dose would be maintained ALARA and within applicable regulatory limits.

Infrastructure

For infrastructure, the cumulative peak load electrical capacity and the water use capacity would be exceeded for the combined LANL Expanded Operations Alternative and a modern pit facility. Planned upgrades to the electrical system should be sufficient to offset the deficit in peak load capacity and ensure that electric energy is available when needed for future operations. For water use, Los Alamos County is currently pursuing additional water rights to supply its water customers including LANL. LANL water requirements have been decreasing compared to the demand in 1999 and are far below projections included in the *1999 SWEIS*. In the near term, no infrastructure capacity constraints are anticipated and LANL demands on infrastructure resources are below projected levels and within site capacities. Potential shortfalls in available capacity will need to be addressed if increased site requirements are realized.

Transportation

The total cumulative worker dose from 100 years of radioactive materials shipments (general transportation, historical DOE shipments, reasonably foreseeable actions, and the LANL SWEIS alternatives) was estimated to be a maximum of 369,230 person-rem, which would result in 222 LCFs. The total cumulative dose to the general public was estimated to be a maximum of 338,530 person-rem which would result in 203 excess LCFs. The total estimated traffic fatalities associated with accidents involving radioactive material and waste transports would be a maximum of 105.

LANL alternatives are expected to result in no more than 3 traffic fatalities and no worker or public cancer deaths (LCFs), and therefore would not contribute substantially to cumulative impacts. For perspective, in 2004, there were 522 traffic fatalities in New Mexico, 58 of which occurred in the three counties neighboring LANL (Los Alamos, Rio Arriba, and Santa Fe counties) (see Table 4–51). Nationwide, in 2004, there were more than 42,000 traffic fatalities.

Traffic could increase on Los Alamos County roads from increased development of both housing and light industry as a result of the conveyance and transfer of lands to Los Alamos County and the Department of Interior in trust for the San Ildefonso Pueblo, increased truck shipments under the Expanded Operations Alternative, and projected increases in LANL's workforces under the Expanded Operations Alternative combined with the possibility that a modern pit facility may be located at LANL. Under this scenario, daily traffic could increase by up to 30 percent.

Approximately 17 percent of the increase would be associated with increased vehicle trips under the Expanded Operations Alternative and 13 percent would be due to operation of a modern pit facility.

Development of land transferred under the Land Conveyance and Transfer EIS could result in an increase in traffic in the vicinity of the airport and TA-21 based on current Los Alamos County plans to develop light industry on these tracts. This action combined with the increased traffic associated with DD&D activities at TA-21 could cause excessive traffic loads on NM 502.

Waste Management

Cumulative generation of all waste types is expected to be substantial, largely due to future remediation of MDAs and DD&D of facilities, and the potential operation of a modern pit facility. Although this would be the case under all alternatives, the quantities of wastes projected under the Expanded Operations Alternative would be significantly greater than those projected under the other alternatives. Sufficient disposal capacity, both on and off site, for all waste types would be available with the following exception. Under the Expanded Operations Alternative with the MDA Removal Option and the operation of a modern pit facility, the projected low-level radioactive waste volume would exceed the on-site disposal capacity, and the projected transuranic waste volume would significantly exceed the volume that was attributed to LANL in the *Waste Isolation Pilot Plan Disposal Phase Final Supplemental Environmental Impact Statement* (DOE 1997b). Therefore, additional resources, including new facilities may be required to augment existing waste management capabilities.

5.14 Mitigation Measures

The regulations promulgated by the CEQ to implement the procedural provisions of NEPA (42 U.S.C. §4321) require that an EIS include a discussion of appropriate mitigation measures (40 CFR 1502.14[f]; 40 CFR 1502.16[h]). The term “mitigation” includes the following:

- Avoiding an impact by not taking an action or parts of an action
- Minimizing impacts by limiting the degree of magnitude of an action and its implementation
- Rectifying an impact by repairing, rehabilitating, or restoring the affected environment
- Reducing or eliminating the impact by preservation and maintenance operations during the life of the action
- Compensating for the impact by replacing or providing substitute resources or environments (40 CFR 1508.20)

This chapter describes mitigation measures that are built into the alternatives analyzed and those additional measures that will be considered by DOE to further mitigate the adverse impacts identified earlier in this chapter. These measures address the range of potential impacts of continuing to operate LANL (including those areas where the lack of information regarding resources or mechanisms for impact to resources results in substantial uncertainty in impact

analyses). The mitigation measures built into the alternatives analyzed (see Section 5.14.1 and 5.14.2) are of two types: (1) existing programs and controls (including regulations, policies, contractual requirements, and administrative procedures); and (2) specific measures built into the alternatives that serve to minimize the effects of activities under the alternatives. The existing programs and controls are too numerous to list here; but a general description is provided, as well as the role of existing programs in operating LANL and pertinent examples of how these mitigate adverse impacts. Additional mitigation measures that could further reduce the adverse impacts identified in this chapter are discussed in Section 5.14.3. The description of these measures in this chapter does not constitute a commitment to undertake any of these measures. Any such commitments would be reflected in the ROD following this SWEIS, with a more detailed description and implementation plan in a Mitigation Action Plan following the ROD.

5.14.1 Existing Programs and Controls

The activities undertaken at LANL are performed within the constraints of applicable regulations, applicable DOE orders, contractual requirements, and approved policies and procedures. The laws and regulations applicable to federal facilities are discussed in Chapter 6; many of these requirements are established with the intent of protecting human health and the environment. It is assumed that these or similar regulatory controls will continue to be in place. These regulations, when complied with, mitigate the potential adverse impacts of operations to the public, the worker, and the environment. For example, the *Clean Air Act* (42 U.S.C. §7401) regulates air emissions and the *Clean Water Act* (33 U.S.C. §1251) regulates liquid effluent discharges in a manner designed to protect human health and reduce the adverse environmental effects of routine operations. In addition to the regulations applicable to LANL, Chapter 6 also discusses other requirements (including DOE orders and external standards and regulations that would not otherwise apply to federal facilities) that apply to operations at LANL through the contract between DOE and its management and operating contractor. As discussed in Chapter 6, these requirements are established and enforced through contractual mechanisms. As with the regulations that apply to LANL, it is assumed that these or similar controls will continue. These requirements also mitigate the potential for adverse impacts. For example, the application of DOE design standards results in facility designs for modern nuclear facilities, which reduce the potential for catastrophic releases from such facilities in the event of earthquakes, high winds, or other natural phenomena. Similarly, the application of occupational safety and health regulations in 29 CFR 1900, et seq, and other standards promulgated by the American National Standards Institute, the U.S. Department of Defense, and DOE, as well as the use of other life safety and fire safety codes and manuals, limit worker exposures to workplace hazards, which reduces the potential for adverse worker health effects. DOE and LANL also have instituted policies and procedures that apply to work conducted at LANL that mitigate the potential adverse effects of operations; it is assumed that these or similar policies and procedures will continue. These are numerous and include, but are not limited to:

- Procedures that institute integrated safety management to control work conducted at LANL (to ensure that work conducted is planned and reviewed, funded, within the applicable regulations and requirements, within the range of risks accepted by DOE and its management and operating contractor, and is otherwise authorized)

- Policies regarding the knowledge, skills, and abilities of personnel assigned to perform hazardous work (including required training)

- Policies reflected in agreements with other entities (such as the Accords with the four Pueblos located nearest to LANL) that establish policies and protocols regarding consultations and other discussions regarding LANL activities

- Policies and procedures regarding the stoppage and restart of work where unexpected hazards or resources are identified (for example, the policies regarding recovery of information from archaeological sites uncovered by excavation)

Work controls reduce potential impacts by ensuring that work conducted is within the range of activities that have been studied for potential environmental and human health effects. Policies regarding the knowledge, skills, and abilities of personnel conducting work at LANL reduce potential impacts by ensuring that only personnel with an appropriate understanding of the work and its potential hazards may undertake that work (which minimizes the potential for adverse human health and environmental effects from inadvertent actions due to a lack of this understanding). Policies for consultations and discussions with other entities mitigate effects by providing an opportunity to avoid or change actions that could cause an adverse impact. For example, consultation with Pueblos could identify the potential to impact traditional cultural properties prior to implementing a construction project or operations and could identify alternative siting or operational approaches that would avoid the impact. Policies and procedures regarding the stoppage and restart of work are similar in effect to work controls; when unexpected situations occur that impose unexpected hazards or reveal unexpected resources (for example, cultural resources), work is stopped (as soon as this can be accomplished safely) until work plans and authorizations can be modified in consideration of the newly uncovered information. This reduces potential impacts in a manner similar to work controls, as discussed above.

DOE also has established programs and projects at LANL to increase the level of knowledge regarding the environment around LANL, health of LANL workers, health of the public around LANL, and the effects of LANL operations on these, as well as to avoid or reduce impacts and remediate contamination from previous LANL activities. These programs and projects reduce potential adverse impacts by providing for heightened understanding of the resources that could be impacted; avoidance of some impacts (where mechanisms for impact to specific resources are known and avoidable); early identification of impacts (which can enable stoppage or mitigation of the impacts); reduction of ongoing impacts; or providing for beneficial management opportunities for natural, cultural, and sensitive resources, where appropriate. It is assumed that such activities will continue at LANL. Examples of these programs and projects are:

- The Environmental Surveillance and Compliance Program at LANL monitors LANL for permit and environmental management requirements. This program also includes evaluation of samples from various environmental media for radioactive materials and other hazardous materials locally and regionally (see Section 4.6.1.2). The data generated under this program are collected routinely and publicly reported at least annually, and these data are analyzed to determine regulatory compliance and to determine environmental trends over long periods of time.

- The Threatened and Endangered Species Habitat Management Plan is intended to provide long-range planning information for future LANL projects, and protect habitat at LANL for these species (see Section 4.5.4).

- DOE recently completed a Cultural Heritage Resources Management Plan for LANL (see Section 4.7). This plan has undergone public review and will be fully implemented through a programmatic agreement between DOE, the New Mexico State Historic Preservation Office, and the Advisory Council on Historic Preservation.

- Flue gas recirculation equipment installed in 2002 on the boilers at the TA-3 power plant has resulted in a 64 percent reduction in NO_x emissions. These controls and administrative controls applied to the steam plant and other sources are used to comply with the emission source limitations and the facility wide emission limitations specified in the LANL's air permit (see Section 4.4.2).

- Studies of public and worker health in and around LANL have been conducted (some by DOE and some by other agencies) to assess human health in the region and to assess the potential for adverse human health effects due to LANL operations (see Section 4.6).

- The Health, Safety, and Radiation Protection Program is conducted by LANL to promote the health and safety of its workers. This program addresses the possible impacts that could result from working with ionizing and non-ionizing radiation, hazardous and chemical materials, and biohazard materials. Appropriate controls that protect the health and safety of workers are determined primarily by the type of hazard and the work environment. The level or amount of controls is commensurate with the risk associated with the hazards that would be encountered by the workers for each job activity.

- LANL's NPDES Industrial Storm Water Permit Program regulates storm water runoff from industrial activities under a Multi-Sector General Permit. Storm water monitoring and erosion controls are required at these sites. An integrated Storm Water Monitoring Program monitors storm water runoff on a watershed basis and at individual solid waste management units. LANL recently began to implement these programs in response to the 2004 Federal Facility Compliance Agreement between the EPA and DOE. The NPDES Construction Storm Water Program regulates storm water from construction activities disturbing 1 acre (0.4 hectares) or more (see Section 4.3.1.3).

- LANL has a Groundwater Protection Management Program to assess current groundwater conditions and monitor and protect groundwater. A Hydrogeologic Work Plan also supplements and verifies existing information on the environmental setting at LANL and collects analytical data on groundwater contamination (see Section 4.3.2).

- The Safeguards and Security Program restricts unauthorized access to areas of LANL with high potential for impact to human health and the environment. Such access restrictions aid in limiting the potential for intentional or inadvertent actions that could result in environmental or human health effects.

- LANL's Emergency Management and Response Program effectively combines Federal and local emergency response capabilities, and provides planning, preparedness, and response capabilities that can aid in containing and remediating the effects of accidents or adverse operational impacts (see Section 4.6.4).

- LANL's Fire Protection Program ensures that personnel and property are adequately protected against fire or related incidents, including fire protection and life safety (see Section 4.6.4).

- An Interagency Wildfire Management Team has been established to coordinate activities related to reducing the fuel loading surrounding the site (see Section 4.5.1). On the site, LANL is implementing actions around individual facilities that have moderate or higher vulnerability to burning as a result of wildfire.

- Waste minimization and pollution prevention efforts at LANL are coordinated by the Pollution Prevention Program. This program works to reduce the wastes generated and to some extent the effluents and emissions from facilities (see Section 4.11).

- Water and energy conservation programs at LANL are intended to reduce use of these resources, which should assist in mitigating the effects of water withdrawal and electrical consumption that occasionally exceed supply (see Section 4.8.2).

- The environmental restoration project at LANL (which includes DD&D) assesses and remediates contaminated sites that either were or still are under LANL control (see Section 4.12). The environmental restoration project serves an important role in reducing the potential for future impacts to human health and the environment due to legacy contaminants in the environment. It is assumed that the current mitigation practices used in remediation actions will continue to be used.

While this list is not all-inclusive, it does reflect the importance of these programs in mitigating the potential adverse impacts of operating LANL.

5.14.2 Mitigation Measures Incorporated in SWEIS Alternatives

Several specific mitigation measures are included in the SWEIS alternatives. Unless otherwise noted below, the analyses in this chapter assume that these measures are implemented. These specific measures are:

- Removal of contamination from MDAs and other PRSs, if necessary, would be conducted in a manner that is protective of the environment and public and worker health and safety. Removal of waste from some large MDAs may require use of temporary containment structures to maintain possible releases of contaminated material to the environment to levels within applicable standards and ALARA. The MDAs where use of containment structures or equivalent measures may be required for safe removal operations include MDAs A, B, T, AB, and G (Expanded Operations Alternative – MDA Removal Option).

- Non-radioactive air emissions such as from construction equipment would be controlled by proper maintenance of equipment.

- Under the Expanded Operations Alternative, noise impacts on sensitive wildlife species during MDA remediation, DD&D, and construction activities would be mitigated by planning activities outside of the breeding season for sensitive species, if any sensitive species' habitat is identified in the area and if the habitat is occupied or the status is uncertain. If appropriate, other protective measures could be employed such as hand digging.

- Under the No Action and Expanded Operations Alternatives, radiological air emissions are monitored and tracked to maintain the annual dose to the public from LANSCE emissions under the administrative limit.

- Under the Expanded Operations Alternative, the Science Complex would be constructed on a site in Northwest TA-62, located west of the Research Park area. This site is bounded to the north by a utility corridor unpaved access road with forested land beyond. The utility corridor access road may be paved in the future to provide all weather access to areas of the Santa Fe National Forest and a local recreational ski facility.

- Under the Expanded Operations Alternative, traffic improvements would be implemented for operation of the new Science Complex on West Jemez Road in TA-62, and the consolidated Warehouse and Truck Inspection Station on East Jemez Road in TA-72 to mitigate the effect of these facilities on traffic flow.

5.14.3 Other Mitigation Measures Considered

In addition to those mitigation measures described above, other feasible mitigation measures considered in the preparation of this SWEIS are presented below:

- Expanded sealed source program procedures would be instituted under the Expanded Operations Alternative which would ensure adequate controls on the quantities and methods of storing sealed sources containing cobalt-60, iridium-192, or cesium-137 to mitigate the effects of potential accidents. This will reduce the potential direct gamma radiation streaming dose from a postulated accident that could compromise the shielding around these gamma emitting radioisotopes.

- Los Alamos County has recently initiated activities aimed at developing a 40-year water plan to address water service needs, balance the uses of water resources, and make recommendations on a water conservation program tailored to meet the specific needs in Los Alamos, including LANL as a Los Alamos County water supply customer. Only the Expanded Operations Alternative is forecast to have water demands that would approach the available water rights from the regional aquifer. Los Alamos County's plans to make use of up to 391 million gallons (1,500 million liters) of water per year from the San Juan-Chama Transmountain Diversion Project as early as 2010 would alleviate any potential shortfall between future demands and current groundwater rights. LANL water use would be mitigated somewhat by the use of recycled water from the Sanitary Effluent Recycle Facility for cooling water.

- Ongoing upgrades to the electrical power transmission and distribution system including construction of a third transmission line would allow the import of additional power into the Los Alamos Power Pool and support a higher electric peak load beyond 2006. In addition, an EA (DOE/EA 1430) was prepared and a FONSI was issued in December 2002 for a project to install two new (20 megawatt), gas-fired combustion turbine generators and to upgrade the existing steam turbines at the TA-3 Co-generation Complex (DOE 2000f). As discussed in Chapter 4, Section 4.9.2.1, upgrades and installation of one, new combustion turbine generator are scheduled to be complete in 2006. While DOE currently has no timeframe for installation of a second combustion turbine generator, its installation in the future would add 20 megawatts (equivalent to 175,200 megawatt-hours) of electrical power generating capacity at LANL.

- Under all of the alternatives, particulate matter (fugitive dust) emissions from exposed soil and roadways during construction activities would be controlled using routine watering as appropriate. As necessary, air pollutant emissions from construction activities and MDA remediation activities would be controlled using standard construction emissions controls. Application of chemical stabilizers to exposed areas, and administrative controls such as planning, scheduling, and use of special equipment could be used to further reduce emissions under all of the alternatives.

- The increased use of foam and vessels for high explosives testing under all of the alternatives could further reduce air pollutant emissions, such as beryllium and depleted uranium, from these activities. The use of foam has been shown to reduce emissions by 50 to more than 80 percent (LANL 2006). The use of vessels for certain tests could reduce emissions by close to 100 percent.

- Traffic and noise impacts on residents of the Royal Crest Mobile Home Park and Los Alamos Town Center from traffic associated with increased truck traffic under the Expanded Operations Alternative could be mitigated by scheduling activity for off peak hours, rerouting truck traffic, using multiple shifts, using alternative entries and exits, and, in the case of TA-21 remediation and DD&D, the possible construction of a bridge or another road off of DP Mesa to allow for alternative routing of traffic. Stockpiling bulk materials on the sites during off-peak hours could also be considered to avoid frequent trips during peak hours.

- To alleviate concerns associated with additional employees commuting to LANL from areas such as Rio Arriba and Santa Fe Counties, it may be necessary to expand the park and ride bus services that are currently offered from Española and Santa Fe.

5.15 Resource Commitments

This section describes the unavoidable adverse environmental impacts that could result from changes in ongoing activities at LANL; the relationship between short-term uses of the environment, and the maintenance and enhancement of long-term productivity; and irreversible and irretrievable commitments of resources. Unavoidable adverse environmental impacts are impacts that would occur after implementation of all feasible mitigation measures. The relationship between short-term uses of the environment and the maintenance and enhancement

of long-term productivity addresses issues associated with the condition and maintenance of existing environmental resources used to support the Proposed Action and the utility of these resources after their use. Resources that would be irreversibly and irretrievably committed are those that cannot be recovered or recycled and those that are consumed or reduced to unrecoverable forms.

5.15.1 Unavoidable Adverse Environmental Impacts

Ongoing activities at LANL under any of the three alternatives analyzed in this SWEIS could result in unavoidable adverse impacts on the human environment. In general, these impacts would be minimal and would come from incremental impacts attributed to ongoing LANL operations.

Ongoing activities at LANL will continue to result in unavoidable radiation and chemical exposure to workers and the general public. The generation of fission products under any of the three alternatives is unavoidable. Radioactive waste generated during operations would be collected, treated and stored, and eventually removed for suitable recycling or disposal in accordance with applicable DOE and EPA regulations.

Operations at LANL under any of the three alternatives would have minimal unavoidable adverse impacts from air emissions. Air emissions include various chemical or radiological constituents in the routine emissions typical of nuclear facility operations. Decontamination and decommissioning of buildings could result in the one-time generation of radioactive and nonradioactive waste material that could affect storage requirements. This could result in an unavoidable impact on the amount of available and anticipated storage space and the requirements of disposal facilities at LANL.

Temporary construction impacts associated with the construction of new facilities at LANL would also be unavoidable. These impacts would include the generation of fugitive dust, noise, and increased construction vehicle traffic.

5.15.2 Relationship Between Local Short-Term Uses of the Environment and Maintenance and Enhancement of Long-Term Productivity

Ongoing operations at LANL under any of the three alternatives could cause short-term commitments of resources and would permanently commit certain resources (such as energy). Environmental resources have already been committed to continuing operations at LANL. Additional commitments would serve to maintain existing environmental conditions with little or no impact on the long-term productivity of the environment.

Short-term commitments of resources could include the space and materials required to construct new buildings, the commitment of new operations support facilities, transportation, and other disposal resources and materials for continued LANL operations. Workers, the public, and the environment could be exposed to increased amounts of hazardous and radioactive materials over the period of this SWEIS analysis from the relocation of materials, including process emissions and the handling of radioactive waste.

Regardless of the location and change in level of activity at LANL Key Facilities, additional air emissions could introduce small amounts of radiological and nonradiological constituents to the air in the region around LANL. These emissions would result in additional loading and exposure, but would not be expected to impact compliance with air quality or radiation exposure standards at LANL. There would be no significant residual environmental effects on long-term environmental viability.

Management and disposal of additional sanitary solid waste and nonrecyclable radiological waste would require the use of energy and space at LANL treatment, storage, or disposal facilities or their replacement offsite disposal facilities. Regardless of location, the land required to meet solid waste needs at LANL would require a long-term commitment of terrestrial resources. Activities being considered at LANL, such as the consolidation of new facilities, could result in the further disturbance, use, and commitment of previously undisturbed land. Ultimately, upon the closure of facilities at LANL, NNSA plans to decontaminate and decommission the buildings and equipment and restore them to brown-field sites, which could be made available for future reuse.

5.15.3 Irreversible and Irretrievable Commitments of Resources

Irreversible and irretrievable commitments of resources unanticipated in the *1999 SWEIS* would include mineral resources consumed during the life of certain projects and energy and water used in operating buildings and facilities at LANL. The commitments of capital, energy, labor, and materials are generally irreversible.

Energy expended would be in the form of fuel for equipment and vehicles, electricity for facility operations, and human labor. Changes in LANL operations could generate nonrecyclable waste streams, such as radiological and nonradiological solid waste and some wastewater. However, certain materials and equipment used during operations could be recycled when buildings are decontaminated and decommissioned.

Operations at LANL require water, electricity, and diesel fuel. These resources are discussed in Section 5.8.2.

The disposal of hazardous and radioactive wastes would also cause irreversible and irretrievable commitments of land, mineral, and energy resources.